Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

Choice Based Credit System (CBCS)

Master of Science (M.Sc. Computer Science)

Syllabus of

M. Sc. Computer Science

Implemented from

Academic year 2022-2023

1. Prologue/ Introduction of the programme:

PREAMBLE: This syllabus is the extension of the existing syllabus which is currently being taught to M.Sc. (Computer Science) of Savitribai Phule Pune University for the last few years, but modified to be placed within the credit based system to be implemented from the academic year 2021-2022. However, there are few changes incorporated in the existing syllabus. It is believed that the proposed changes as part of the credit based system will bring a qualitative change in the way M.Sc. (Computer Science) is taught, which will offer a more enriched learning experience. It aims to provide technology-oriented students with the knowledge and ability to develop creative solutions, and better understand the effects of future developments of computer systems and technology on people and society. The syllabus is about developing skills to learn new technology, grasping the concepts and issues behind its use and the use of computers.

2. Programme outcomes (Pos):

- Unify the students to take up a career in the highly competitive IT industry with research and development skills acquired through minor and major projects.
- Equip students with comprehensive knowledge and understanding of advanced theoretical fundamentals in computer science as well as contemporary key research issues in specialized areas of computer science.
- Provide freedom to choose subjects of interest from the list of specialized courses and to allow the students to follow the career path they have dreamt of.
- Attain knowledge in the advanced areas of computer science especially Algorithms Design, Artificial Intelligence, Data Science and Information Security.

Credit Distribution

Distribution of credits

Type of Courses	Total Credits	Credits/ semester
Discipline Specific Core Courses (DSCC)	54	17(only I, II and III,IV)
Discipline Specific Elective Courses (DSCE	12	04(only I, II and III)
Generic Elective	06	02 (only I, II and III)
Industrial Internship (DSCC)	16	18 (IV Semester)
Total	88	22

Master of Science (M.Sc.) Course Distribution

Class	Semester	Subjects	Courses	DSCC		DSEC		GE	Industrial Internship	Total Credits
				T	P	T	P	T or P		
M.Sc. I	I	01	09	03	01	02	02	01		22
M.Sc. I	II	01	09	03	01	02	02	01		22
M.Sc. II	III	01	09	03	01	02	02	01		22
M.Sc. II	**IV**	**01**	**02**	**01**					**01**	**22**

Master of Science (M.Sc.) Credit Distribution

Class	Semester	Subjects	Courses	DSCC		DSEC		GE		Project	Total Credits
				T	P	T	P	T/P	P		
M.Sc. I	I	01	09	12	04	02	02	02	00	00	22
M.Sc. I	I	01	09	12	04	02	02	02	00	00	22
M.Sc. II	III	01	09	12	04	02	02	02	00	00	22
M.Sc. II	IV	01	02	04	00	00	00	00	00	18	22

- The students need to complete the DSCC and DSEC credit from the parent department and Generic Elective and Industrial Internship credits can be earned from any Department from the college or industry.

4. Structure of CGPA and Marking Scheme of CBCS for M.Sc Computer Science.

Semester -I

Course Code	Type of Course	Course Name	Credits	Max Int Marks	Max Ext Marks	Total
MSC-CS 111 T	T	Paradigm of Programming Language	04	30	70	100
MSC-CS 112 T	T	Database Technologies	04	30	70	100
MSC-CS 113 T	T	Design and Analysis of Algorithms	02	15	35	50
MSC-CS 114 P	P	Paradigm of Programming Language Practical	02	15	35	50
MSC-CS 115 P	P	Database Technologies Practical	02	15	35	50
MSC-CS 116 P	P	Project	02	15	35	50
MSC-CS 117 T(A)	T	Artificial Intelligence	02	15	35	50
MSC-CS 118 P(A)	P	Artificial Intelligence Practical	02	15	35	50
		OR				
MSC- CS 117 T(B)	T	Cloud Computing	02	15	35	50
MSC-CS 118 P(B)	P	Cloud Computing Practical	02	15	35	50
MSC-CS 119 T	T	Research Methodology	02	15	35	50
Semester Total			**22**	**165**	**385**	**550**

Semester -II

Course Code	Type	Course Name	Credits	Max Int Marks	Max Ext Marks	Total
MSC-CS 211 T	T	Advanced Operating System	04	30	70	100
MSC-CS 212 T	T	Information System Security	04	30	70	100
MSC-CS 213 T	T	Mobile Technologies	02	15	35	50
MSC-CS 214 P	P	Advanced Operating System Practical	02	15	35	50
MSC-CS 215 P	P	Mobile Technologies Practical	02	15	35	50
MSC-CS 216 P	P	Introduction to System Security Practical	02	15	35	50
MSC-CS 217 T(A)	T	Dot Net	02	15	35	50
MSC-CS 218 P(A)	P	Dot Net Practical	02	15	35	50
		OR				
MSC-CS 217 T(B)	T	Soft Computing	02	15	35	50
MSC-CS 218 P(B)	P	Soft Computing Practical	02	15	35	50
		OR				
MSC-CS 217 T(C)	T	Network Cyber Security	02	15	35	50
MSC-CS 218 P(C)	P	Network Cyber Security Lab	02	15	35	50
MSC-CS 219 T	T	Internet of Things (IOT)	02	15	35	50
		Semester Total	**22**	**165**	**385**	**550**

Semester-III

Course Code	Type	Course Name	Credits	Max Int Marks	Max Ext Marks	Total
MSC-CS 311 T	T	Software Project Management	04	30	70	100
MSC-CS 312 T	T	Machine Learning	04	30	70	100
MSC-CS 313 T	T	Advanced Database Management System	02	15	35	50
MSC-CS 314 P	P	Software Project Management Lab , Mini Project	02	15	35	50
MSC-CS 315 P	P	Machine Learning Practical	02	15	35	50
MSC-CS 316 P	P	SQL Server Management System Lab	02	15	35	50
MSC-CS 317 T(A)	T	Big Data	02	15	35	50
MSC-CS 318 P(A)	P	Big Data Practical	02	15	35	50
		OR				
MSC-CS 317 T(B)	T	Web Analytics	02	15	35	50
MSC-CS 318 P(B)	P	Web Analytics Practical	02	15	35	50
		OR				
MSC-CS 317 T(C)	T	Block Chain Management	02	15	35	50
MSC-CS 318 P(C)	P	Block Chain Practical	02	15	35	50
MSC-CS 319 T	T	Data Mining & Data Warehousing	02	15	35	50
		Semester Total	**22**	**165**	**385**	**550**

Semester-IV

Semester	Course Code	Type of Course	Course Name	Credits	Maximum Internal Marks	Maximum External Marks	Total
IV	**MSC-CS 411 P**	Project	Industrial Training /Institutional Project	18	100	300	400
IV	**MSC-CS 412 T**	DSCC	Course Work	04	150	-	150
Semester Total				**22**	**250**	**300**	**550**

5. Distribution of Internal and External Marks

Class	Semester	Credit	Internal Evaluation	External Evaluation	Total Maximum Marks
M.Sc-CS	I	22	165	385	550
M.Sc-CS	II	22	165	385	550
M.Sc-CS	III	22	165	385	550
M.Sc-CS	IV	22	250	300	550
	04	88	745	1455	2200

- **For Each Semester (I, II and III) student has to select any one theory and practical course(Total 4 credits) from DSEC.**

Additional grade-based credits for all UG Programmes

Sr. No.	Title	Credits	Remark
1.	Democracy, Election and Governance: Semester I	02	Compulsory
2.	Physical Education: Semester II	02	Compulsory
3.	Completion of skill-based certificate programme organized by any department of the college	02	Compulsory
4.	SWAYAM certificate course	02	Optional
5.	Participation in NSS Winter Camp	02	Optional
6.	'C' Certificate in NCC	02	Optional
7.	Selection and participation in RDC parade at New Delhi	02	Optional
8.	Representation at State/ National level Co-curricular Activities	02	Optional
9.	Representation at State/ National level Extra-curricular Activities	02	Optional
10.	Winning Medal/ Prize at International/National level Co-curricular/ Extracurricular activities	02	Optional
11.	Prize in Curricular/ Extracurricular/ Cultural Activities at college level	01	Optional
12.	Active participation in Excursion tours/Study tours and Experiential Learning Activities	01	Optional
13.	Survey Report	02	Optional
14.	Book Review on a book suggested by the Academic Council	02	Optional

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New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus of

M. Sc. Computer Science

(Faculty of Science and Technology)

Semester – I

Sr. No.	Class	Course Code	Course Title	Credits
1.	**M.Sc. Computer Science - I**	**MSC-CS 111 T**	Paradigm of Programming Language	04
2.	**M.Sc. Computer Science - I**	**MSC-CS 112 T**	Database Technologies	04
3.	**M.Sc. Computer Science - I**	**MSC-CS 113 T**	Design and Analysis of Algorithms	02
4.	**M.Sc. Computer Science - I**	**MSC-CS 114 P**	Paradigm of Programming Language Practical	02
5.	**M.Sc. Computer Science - I**	**MSC-CS 115 P**	Database Technologies Practical	02
6.	**M.Sc. Computer Science - I**	**MSC-CS 116 P**	Project	02
7.	**M.Sc. Computer Science - I**	**MSC-CS 117 T(A)**	Artificial Intelligence	02
8.	**M.Sc. Computer Science - I**	**MSC-CS 118 P(A)**	Artificial Intelligence Practical	02
OR				
7	**M.Sc. Computer Science - I**	**MSC- CS 117 T(B)**	Cloud Computing	02
8.	**M.Sc. Computer Science - I**	**MSC-CS 118 P(B)**	Cloud Computing Practical	02
9.	**M.Sc. Computer Science - I**	**MSC-CS 119 T**	Research Methodology	02

Semester – II

Sr. No.	Class	Course Code	Course Title	Credits
10	**M.Sc. Computer Science - I**	**MSC-CS 211 T**	Advanced Operating System	04
11	**M.Sc. Computer Science - I**	**MSC-CS 212 T**	Information System Security	04
12	**M.Sc. Computer Science - I**	**MSC-CS 213 T**	Mobile Technologies	02
13	**M.Sc. Computer Science - I**	**MSC-CS 214 P**	Advanced Operating System Practical	02
14	**M.Sc. Computer Science - I**	**MSC-CS 215 P**	Mobile Technologies Practical	02
15	**M.Sc. Computer Science - I**	**MSC-CS 216 P**	Introduction to System Security Practical	02
16	**M.Sc. Computer Science - I**	**MSC-CS 217 T(A)**	Dot Net	02
17	**M.Sc. Computer Science - I**	**MSC-CS 218 P(A)**	Dot Net Practical	02
OR				
16	**M.Sc. Computer Science - I**	**MSC-CS 217 T(B)**	Soft Computing	02
17	**M.Sc. Computer Science - I**	**MSC-CS 218 P(B)**	Soft Computing Practical	02
OR				
18	**M.Sc. Computer Science - I**	**MSC-CS 217 T(C)**	Network Cyber Security	02
19	**M.Sc. Computer Science - I**	**MSC-CS 218 P(C)**	Network Cyber Security Lab	02
20	**M.Sc. Computer Science - I**	**MSC-CS 219 T**	Internet of Things (IOT)	02

Semester – III

Sr. No.	Class	Course Code	Course Title	Credits
19	**M.Sc. Computer Science - II**	**MSC-CS 311 T**	Software Project Management	04
20	**M.Sc. Computer Science - II**	**MSC-CS 312 T**	Machine Learning	04
21	**M.Sc. Computer Science - II**	**MSC-CS 313 T**	Advanced Database Management System	02
22	**M.Sc. Computer Science - II**	**MSC-CS 314 P**	Software Project Management Lab , Mini Project	02
23	**M.Sc. Computer Science - II**	**MSC-CS 315 P**	Machine Learning Practical	02
24	**M.Sc. Computer Science - II**	**MSC-CS 316 P**	SQL Server Management System Lab	02
25	**M.Sc. Computer Science - II**	**MSC-CS 317 T(A)**	Big Data	02
26	**M.Sc. Computer Science - II**	**MSC-CS 318 P(A)**	Big Data Practical	02
OR				
25	**M.Sc. Computer Science - II**	**MSC-CS 317 T(B)**	Web Analytics	02
26	**M.Sc. Computer Science - II**	**MSC-CS 318 P(B)**	Web Analytics Practical	02
OR				
27	**M.Sc. Computer Science - II**	**MSC-CS 317 T(C)**	Block Chain Management	02
28	**M.Sc. Computer Science - II**	**MSC-CS 318 P(C)**	Block Chain Practical	02
29	**M.Sc. Computer Science - II**	**MSC-CS 319 T**	Data Mining & Data Warehousing	02

Semester – IV

Sr. No.	Class	Course Code	Course Title	Credits
28	**M.Sc. Computer Science - II**	**MSC-CS 411 P**	Industrial Training /Institutional Project	22

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New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus of

M. Sc. Computer Science

(Faculty of Science and Technology)

Sr. No.	Class	Semester	Course Code	Course Title	Credits
1	**M.Sc. Computer Science - I**	**I**	**MSC-CS 111 T**	**Paradigm of Programming Language**	04
2	**M.Sc. Computer Science - I**	**I**	**MSC-CS 112 T**	**Database Technologies**	04
3	**M.Sc. Computer Science - I**	**I**	**MSC-CS 113 T**	**Design and Analysis of Algorithms**	02
4	**M.Sc. Computer Science - I**	**I**	**MSC-CS 114 P**	**Paradigm of Programming Language Practical**	02
5	**M.Sc. Computer Science - I**	**I**	**MSC-CS 115 P**	**Database Technologies Practical**	02
6	**M.Sc. Computer Science - I**	**I**	**MSC-CS 116 P**	**Project**	02
7	**M.Sc. Computer Science - I**	**I**	**MSC-CS 117 T(A)**	**Artificial Intelligence**	02
8	**M.Sc. Computer Science - I**	**I**	**MSC-CS 118 P(A)**	**Artificial Intelligence Practical**	02
OR					
7	**M.Sc. Computer Science - I**	**I**	**MSC-CS117 T(B)**	**Cloud Computing**	02
8	**M.Sc. Computer Science - I**	**I**	**MSC-CS 118 P(B)**	**Cloud Computing Practical**	02
9	**M.Sc. Computer Science - I**	**I**	**MSC-CS 119 T**	**Research Methodology**	02

10	**M.Sc. Computer Science - I**	**II**	**MSC-CS 211 T**	**Advanced Operating System**	04
11	**M.Sc. Computer Science - I**	**II**	**MSC-CS 212 T**	**Information System Security**	04
12	**M.Sc. Computer Science - I**	**II**	**MSC-CS 213 T**	**Mobile Technologies**	02
13	**M.Sc. Computer Science - I**	**II**	**MSC-CS 214 P**	**Advanced Operating System Practical**	02
14	**M.Sc. Computer Science - I**	**II**	**MSC-CS 215 P**	**Mobile Technologies Practical**	02
15	**M.Sc. Computer Science - I**	**II**	**MSC-CS 216 P**	**Introduction to System Security Practical**	02
16	**M.Sc. Computer Science - I**	**II**	**MSC-CS 217 T(A)**	**Dot Net**	02
17	**M.Sc. Computer Science - I**	**II**	**MSC-CS 218 P(A)**	**Dot Net Practical**	02
			OR		
16	**M.Sc. Computer Science - I**	**II**	**MSC-CS 217 T(B)**	**Soft Computing**	02
17	**M.Sc. Computer Science - I**	**II**	**MSC-CS 218 P(B)**	**Soft Computing Practical**	02
			OR		
16	**M.Sc. Computer Science - I**	**II**	**MSC-CS 217 T(C)**	**Network Cyber Security**	02
17	**M.Sc. Computer Science - I**	**II**	**MSC-CS 218 P(C)**	**Network Cyber Security Lab**	02
18	**M.Sc. Computer Science - I**	**II**	**MSC-CS 219 T**	**Internet of Things (IOT)**	02
19	**M.Sc. Computer Science - II**	**III**	**MSC-CS 311 T**	**Software Project Management**	04
20	**M.Sc. Computer Science - II**	**III**	**MSC-CS 312 T**	**Machine Learning**	04

21	**M.Sc. Computer Science - II**	**III**	**MSC-CS 313 T**	**Advanced Database Management System**	02
22	**M.Sc. Computer Science - II**	**III**	**MSC-CS 314 P**	**Software Project Management Lab , Mini Project**	02
23	**M.Sc. Computer Science - II**	**III**	**MSC-CS 315 P**	**Machine Learning Practical**	02
24	**M.Sc. Computer Science - II**	**III**	**MSC-CS 316 P**	**SQL Server Management System Lab**	02
25	**M.Sc. Computer Science - II**	**III**	**MSC-CS 317 T(A)**	**Big Data**	02
26	**M.Sc. Computer Science - II**	**III**	**MSC-CS 318 P(A)**	**Big Data Practical**	02
			OR		
25	**M.Sc. Computer Science - II**	**III**	**MSC-CS 317 T(B)**	**Web Analytics**	02
26	**M.Sc. Computer Science - II**	**III**	**MSC-CS 318 P(B)**	**Web Analytics Practical**	02
			OR		
25	**M.Sc. Computer Science - II**	**III**	**MSC-CS 317 T(C)**	**Block Chain Management**	02
26	**M.Sc. Computer Science - II**	**III**	**MSC-CS 318 P(C)**	**Block Chain Practical**	02
27	**M.Sc. Computer Science - II**	**III**	**MSC-CS 319 T**	**Data Mining & Data Warehousing**	02
28	**M.Sc. Computer Science - II**	**IV**	**MSC-CS 411 P**	**Industrial Training /Institutional Project**	22

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Syllabus of M. Sc. Computer Science
under
Faculty of Science and Technology

Semester –I	**Paper -I**
Course Code: MSC-CS 111T	**Title of the Course:** Paradigm of Programming Language
Credits: 04	**Total Lectures:** 60 Hrs

Course Outcomes (Cos)

To Prepare student to think about programming languages analytically:

- Separate syntax from semantics
- Compare programming language designs
- Understand their strengths and weaknesses
- Learn new languages more quickly
- Understand basic language implementation techniques

Unit	Course Contents	Allotted Hours
Unit I	**Introduction** 1.1 The Art of Language Design. 1.2 The Programming LanguageSpectrum. 1.3 Why Study ProgrammingLanguages? 1.4 Compilation and Interpretation. 1.5 Programming Environments.	**(02)**
Unit II	**Names, Scopes, and Bindings** 2.1 The Notion of Binding Time. 2.2 Object Lifetime and StorageManagement. 2.3 Static Allocation, Stack-Based Allocation, Heap-Based Allocation,Garbage Collection Scope Rules. 2.4 Static Scoping, Nested Subroutines, Declaration Order, Dynamic ScopingThe meaning of Names in a Scope. 2.5 Aliases, Overloading, Polymorphism and Related Concepts, the Binding ofReferencing Environments. 2.6 Subroutine Closures, First-Class Values and Unlimited Extent, ObjectClosures Macro Expansion.	**(05)**

Unit III **Control Flow** **(08)**

3.1 Expression Evaluation, Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation.
3.2 Structured and Unstructured Flow,Structured Alternatives to goto..
3.3 Sequencing.
3.4 Selection - Short-Circuited Conditions, Case/Switch StatementsIteration.
3.5 Iteration - Enumeration-Controlled Loops, Combination Loops, Iterators,Logically Controlled Loops Recursion.
3.6 Recursion - Iteration and Recursion,Applicative- and Normal-Order Evaluation.

Unit IV **Data Types** **(10)**

4.1 Introduction.
4.2 Primitive Data Types.
4.3 Numeric Types: Integer, Floating point, Complex, Decimal, BooleanTypes, Character Types.
4.4 Character String Types.
4.5 Design Issues, Strings and Their Operations, String Length Operations, Evaluation, Implementation of Character StringTypes.
4.6 User defined Ordinal Types Enumeration types, Designs Evaluation Subrange types, Ada's design Evaluation Implementation ofuser defined ordinal types
4.7 Array types
4.8 Design issues, Arrays and indices, Subscript bindings and array categories, Heterogeneous arrays, Array initialization, Array operations,Rectangular and Jagged arrays, Slices, Evaluation, Implementation ofArray Types
4.9 Associative Arrays Structure and operations, Implementing associative arrays,
4.10 Record types
4.11 Definitions of records, Referencesto record fields, Operations on records, Evaluation, Implementation of Record types
4.12 Union Types
4.13 Design issues, Discriminatedversus Free unions, Evaluation, Implementation of Union types.
4.14 Pointer and Reference Types
4.15 Design issues, Pointer operations, Pointer problems, dangling pointers, Lost heap dynamic variables, Pointers in C andC++, Reference types, Evaluation
4.16 Implementation of pointer andreference types - Representation ofpointers and references Solution to dangling pointer problem Heap management

Unit V **Subprograms and Implementing Subprograms** **(10)**

5.1 Introduction
5.2 Fundamentals of Subprograms
5.3 Design Issues for subprograms
5.4 Local Referencing Environments
5.5 Parameter-Passing Methods
5.6 Parameters That Are
5.7 Subprograms
5.8 Overloaded Subprograms
5.9 Generic Subroutines, Generic Functions in C++, Generic Methodsin Java
5.10 Design Issues for Functions User-Defined Overloaded Operators
5.11 Coroutines
5.12 Implementing Subprograms
5.13 The General Semantics of Callsand Returns
5.14 Implementing "Simple" Subprograms Implementing Subprograms with Stack Dynamic Local Variables
5.15 Nested Subprograms
5.16 Blocks
5.17 Implementing Dynamic Scoping

Unit VI **Data Abstraction and Object Orientation** **(08)**

6.1 Object-Oriented Programming
6.2 Encapsulation and Inheritance Modules, Classes, Nesting (Inner Classes), Type Extensions, Extendingwithout Inheritance
6.3 Initialization and Finalization Choosing a Constructor, Referencesand Values, Execution Order, Garbage Collection
6.4 Dynamic Method Binding
6.5 Virtual- and Non-Virtual Methods, Abstract Classes, Member Lookup,Polymorphism, Object Closures
6.6 Multiple Inheritance • Semantic Ambiguities, Replicated Inheritance,

Unit VII **Concurrency** **(07)**

7.1 Introduction: MultiprocessorArchitecture Categories of concurrency, Motivations for studying concurrency
7.2 Introduction to Subprogram-level, concurrency Fundamental concepts,Language Design for concurrency, Design Issues
7.3 Semaphores - Introduction Cooperation synchronization,Competition Synchronization, Evaluation
7.4 Monitors - Introduction, Cooperationsynchronization, Competition Synchronization, Evaluation,
7.5 Message Passing Introduction- Theconcept of

Synchronous Message Passing
7.6 Java Threads - The Thread class –Priorities, Competition Synchronization Cooperation Synchronization, Evaluation

Unit VIII **Functional Programming in Scala** **(10)**

8.1 Strings
8.2 Numbers
8.3 Control Structures
8.4 Classes and Properties
8.5 Methods
8.6 Objects
8.7 Functional Programming
8.8 List, Array, Map, Set

Suggested Readings:

Sr. No.	Title of the Book	Author/s	Publication
1	Programming Language Pragmatics, 3e	Michel L. Scott	Kaufmann Publishers, An Imprint of Elsevier, USA
2	Concepts of Programming Languages, Eighth Edition	Robert W. Sebesta	Pearson Education
3	Scala Cookbook	Alvin Alexander	O'REILLY publication

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Semester –I	**Paper –II**
Course Code: MSC-CS 112 T	**Title of the Course :** Database Technologies
Credits: 04	**Total Lectures: 60 Hrs**

Course Outcomes (Cos):

- Provide an overview of the concept of NoSQL technology.
- Provide an insight to the different types of NoSQL databases
- Make the student capable of making a choice of what database technologies to use, based on their application needs.

Unit	Course Contents	AllottedHours
Unit I	**Introduction to NOSQL (Core concepts)**	**(20)**
	1.1 Why NoSQL	
	1.2 Aggregate Data Models	
	1.3 Data modeling details	
	1.4 Distribution Models	
	1.5 Consistency	
	1.6 Version stamps	
	1.7 Map-Reduce	
Unit II	**Implementation with NOSQL databases**	**(18)**
	2.1 Key-Value Databases (Riak)	
	2.2 Document Databases (Mongodb)	
	2.3 Column-Family stores (Cassandra)	
	2.4 Graph databases (Neo4j)	

Unit III	**Schema Migrations**	**(8)**
Unit IV	**Polygot Persistence (Multi model types)**	**(8)**
Unit V	**Beyond NoSQL**	**(3)**
Unit VI	**Choosing your database**	**(3)**

Suggested Readings:

Sr. No.	Title of the Book	Author/s
1	NoSQL Distilled	Pramod Sadalge,Martin Fowler
2	NoSQL for Dummies	A Willy Brand
3	http://nosql-database.org	

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Semester –I	**Paper –III**
Course Code: MSC-CS 113T	**Title of the Course:** Design and Analysis of Algorithms
Credits: 02	**Total Lectures: 30 Hrs**

Course Outcomes (Cos):

- To design the algorithms
- To select the appropriate algorithm by doing necessary analysis of algorithms
- To learn basic Algorithm Analysis techniques and understand the use of asymptotic notation
- Understand different design strategies
- Understand the use of data structures in improving algorithm performance

Unit	Course Contents	Allotted Hours
UNIT I	**Basics of Algorithms** 1.1 Algorithm definition and characteristics 1.2 Space complexity 1.3 Time complexity, worst case-best case-average case 1.4 complexity, asymptotic notation 1.5 Recursive and non-recursive algorithms 1.6 Sorting algorithms (insertion sort, heapsort, bubble sort) 1.7 Sorting in linear time: counting sort,concept of bucket and radix sort 1.8 Searching algorithms: Linear, Binary	**(09)**
UNIT II	**Divide and conquer strategy** 2.1 General method, control abstraction 2.2 Binary search 2.3 Merge sort, Quick sort 2.4 Comparison between Traditional Method ofMatrix Multiplication vs. Strassen's Matrix Multiplication	**(04)**

UNIT III Dynamic Programming **(07)**

3.1 Principle of optimality
3.2 Matrix chain multiplication
3.3 0/1 Knapsack Problem
i) Merge & Purge
ii) Functional Method
3.4 Concept of Shortest Path
3.5 Single Source shortest path
i) Dijkstra's Algorithm
ii)Bellman Ford Algorithm
3.6 All pairs Shortest Path
3.7 Floyd- Warshall's Algorithm
3.8 Longest common subsequence,
3.9 String editing, Travelling Salesperson problem

UNIT IV Greedy Method **(06)**

4.1 Job sequencing with deadlines,
4.2 Minimum-cost spanning trees: Kruskal's and Prim's algorithm
4.3 Optimal storage on tapes
4.4 Optimal merge patterns
4.5 Huffman coding
4.6 Shortest Path: Dijkstra's algorithm

UNIT V Decrease and Conquer **(04)**

5.1 Definition of Graph Representation of Graph
5.2 5.2By Constant - DFS and BFS
5.3 Topological sorting
5.4 Connected components and spanning trees 5.5By Variable Size decrease Euclid's algorithm5.6Flow in graph
5.7Articulation Point and Bridge edge

Suggested Readings:

Sr. No.	Title of the Book	Author/s	Publication
1	Computer algorithms	Ellis Horowitz, Sartaj Sahni &Sanguthevar Rajasekaran	Galgotia Publication
2	T. Cormen, C. Leiserson, & R. Rivest	Algorithms	MIT Press
3	A. Aho, J. Hopcroft & J. Ullman	The Design andAnalysis of Computer Algorithms	Addison Wesley
4	Donald Knuth	The Art ofComputer Programming	Addison Wesley
5	Steven Skiena	The Algorithm Manual	Springer
6	Jungnickel	Graphs, Networks and Algorithms	Springer

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus of M. Sc. Computer Science
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Semester –I	**Paper -IV**
Course Code: MSC-CS 114 P	**Title of the Course:** Paradigm of Programming Language Practical
Credits: 02	**Total Lectures:** 60 Hrs

Course Outcomes (Cos):

- Understand the features of SCALA language with different object- oriented features
- Acknowledge the functional programming with SCALA
- understand and write programs in the Scala programming language.

Course Contain

LIST OF SCALA PROGRAMS (PPL)

Control Structures

1. Write a program to calculate average of all numbers between n1 andn2(eg.100 to 300 Read values of n1 and n2 from user)
2. Write a program to calculate factorial of a number.
3. Write a program to read five random numbers and check that random numbers are perfect number or not.
4. Write a program to find second maximum number of four givennumbers.
5. Write a program to calculate sum of prime numbers between 1 to 100
6. Write a program to read an integer from user and convert it to binary and octal using user defined functions.

Arrays

1. Write a program to find maximum and minimum of an array
2. Write a program to calculate transpose of a matrix.
3. Write a program to calculate determinant of a matrix,
4. Write a program to check if the matrix is upper triangular or not.
5. Write a program to sort the matrix using insertion sort.
6. Write aprogram for multiplication of two matrices (Validate number of rowsand columns before multiplication and give appropriate message)

String

1. Write a program to count uppercase letters in a string and convert it to lowercase and display the new string.
2. Write a program to read a character from user and count the numberof occurrences of that

character.

3. Write a program to read two strings. Remove the occurrence of second string in first string.
4. Create array of strings and read a string from user. Display all the elements of array containing given string.

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Semester –I	**Paper -V**
Course Code: MSC-CS 115 P	**Title of the Course : Database TechnologiesPractical**
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes (Cos):

Learn to design Schema using Advanced Queries and CRUD operations using MongoDB

- Use mongo DB Aggregation framework
- Learn about Neo4j, it's features, benefits, and use cases
- Understand how to manage data using the service

Database Technologies: MongoDB PracticalAssignment 1

Create a database with the name 'Movie'.

1. A 'Film' is a collection of documents with the following fields:

a. Film Id
b. Title of the film
c. Year of release
d. Genre / Category (like adventure, action, sci-fi, romantic etc.) Afilm can belong to more than one genre
e. Actors (First name and Last name) A film can have more than one actor.
f. Director (First name and Last name) A film can have more thanone director.
g. Release details (It consists of places of release, dates of releaseand rating of the film.)
h. An 'Actor' is a collection of documents with the following fields:
i. Actor Id b. First name c. Last Name d. Address (Street, City, State, Country, Pin-code) e. Contact Details (Email Id and PhoneNo) f. Age of an actor.

Queries:

1. Insert at least 10 documents in the collection Film – a. Insert at least one document with film belonging to two genres. b. Insert at least one document with film that is released at more than one place and on two different dates. c. Insert at least three documents with thefilms released in the same year. d. Insert at least two documents withthe films directed by one director. e. Insert at least two documents with films those are acted by a pair 'Madhuri Dixit' and 'Shahrukh Khan'.
2. Insert at least 10 documents in the collection Actor. Make sure, you are

inserting the names of actors who have acted in films, givenin the 'Film' collection.

3. Display all the documents inserted in both the collections.
4. Add a value to the rating of the film whose title starts with 'T'.
5. Add an actor named " " in the 'Actor' collection. Also add the details of the film in 'Film' collection in which this actor has actedin.
6. Delete the film " ".
7. Delete an actor named " ".
8. Delete all actors from an 'Actor' collection who have age greaterthan " "
9. Update the actor's address where Actor Id is " ".
10. Update the genre of the film directed by ". M. Sc.[I] Computer Science"

Database Technologies: MongoDBPractical Assignment 2

1. Create a database with name 'Company'.
2. An 'Employee' is a collection of documents with the following fields: a. Employee ID b. First Name c. Last Name d. Email e. PhoneNo. f. Address (House No, Street, City, State, Country, Pin-code) g. Salary h. Designation i. Experience j. Date of Joining k. Birthdate
3. A 'Transaction' is a collection of documents with the following fields: a. Transaction Id, b. Transaction Date c. Name (First Name ofemployee who processed the transaction) d. Transaction Details (Item Id, Item Name, Quantity, Price) e. Payment (Type of Payment (Debit/Credit/Cash), Total amount paid, Payment Successful) f. Remark (Remark field can be empty.)

Queries:

1. Insert at least 5 documents in 'Employee' collection.
2. Insert multiple documents (at least 10) into the 'Transaction'collection by passing an array of documents to the db.collection.insert () method.
3. Display all the documents of both the collections in a formattedmanner.
4. Update salary of all employees by giving an increment of Rs.4000.
5. Update the remark for transaction id 201.
6. Update designation of an employee named "_ " from supervisor tomanager.
7. Update designation of an employee having Employee Id as .
8. Change the address of an employee having Employee Id as .

Delete transaction made by " " employee on the given date.

10.Delete all the employees whose first name starts with 'K'.

Computer Science Database Technologies: MongoDBPractical Assignment 3

This assignment is based on 'Movie' database having collections 'Film' and 'Actor'. Prerequisite: Read MongoDB Aggregate framework before executing the following assignments. Note: It isexpected that student should fill in the data relevant to the queries given in the assignment. The result set should not be empty.

1. Find the titles of all the films starting with the letter 'R' releasedduring the
2. year 2009 and 2011.

3. Find the list of films acted by an actor " ".
4. Find all the films released in 90s.
5. Find all films belonging to “Adventure” and “Thriller” genre.
6. Find all the films having ‘A’ rating.
7. Arrange the film names in ascending order and release year should be in descending order.
8. Sort the actors in ascending order according to their age.
9. Findmovies that are comedies or dramas and are released after 2013.
10. Show the latest 2 films acted by an actor “ ”
11. List the titles of films acted by actors “ ” and “ ”.
12. Retrieve films with an actor living in Spain.
13. Retrieve films with actor details.

Note: Similarly, additionalqueries can be executed based on these collections for practice.

Computer Science Database Technologies:MongoDB Practical Assignment4

This assignment is based on ‘Company’ database having collections‘Employee’ and ‘Transaction’. Prerequisite: Read MongoDB Aggregate framework before executing the following assignments. Note: It is expected that student should fill in the data relevant to thequeries given in the assignment. The result set should not be empty.

1. Find employees having designation as either ‘manager’ or ‘floor supervisor’.
2. Find an employee whose name ends with " " and print the output injson format.
3. Display the name of an employee whose salary is greater thanusing a MongoDB cursor.
4. Sort the employees in the descending order of their designation.
5. Count the total number of employees in a collection.
6. Calculate the sum of total amount paid for all the transaction documents.
7. Calculate the sum of total amount paid for each payment type.
8. Find the transaction id of the latest transaction.
9. Find designation of employees who have made transaction of amount greater than Rs. 500.
10. Find the total quantity of a particular item sold using MapReduce.

Database Technologies Neo4jPractical Assignment 1

Create the following databases as graph models. Visualize the models after creation, return properties of nodes, Return the nodeslabels, Return the relationships with its properties. NB: You may assume and add more labels, relationships, properties to the graphs.

1. Create a library database, as given below.

There are individual books, readers, and authors that are present in the library

data model. A minimal set of labels are as follows:
Book: This label includes all the books
Person: This label includes authors, translators, reviewers, Readers, Suppliers and so on.
Publisher: Thislabel includes the publishers of books in the database
A set of basic relationships are as follows: Published By: This relationship is used to specify that a book was published by a publisher.
Votes: This relationship describes the relation between a user and a book, for example, how a book was rated by a user. Reviewed By : This relationship is used to specify that a book was reviewed and remarked by a user. TranslatedBy: This relationship is used to specify that a book was translated to a language by a user. IssuedBy:This relationship is used to specify that a book was issued by a user.ReturnedBy: This relationship is used to specify that a book was returned by a user Every book has the following properties: Title: This is the title of the book in string format Computer Science Tags: This is an array of string tags useful for searching through the database based on topic, arguments,geographic regions, languages, and so on Status: the book status , specifying whether its issued or in library. Condition: book condition, new or old Cost : Cost of book Type: book is a Novel, Journal, suspense thriller etc.
2. Consider a Song database, with labels as Artists, Song Recording company, Recording studio, song author etc.Relationships can be as follows Artist→[Performs]→Song →[Written by]→Song_author. Song →[Recorded in] →RecordingStudio →[managed by] →recordingCompany Recording Company →[Finances] →Song You may add more labels and relationship andtheir properties, as per assumptions.
3.Consider an Employee database, with a minimal set of labels as follows Employee: denotes a person as an employee of the organization Department: denotes the different departments, in whichemployees work. Skillset: A list of skills acquired by an employee Projects: A list of projects in which an employee works. A minimal set of relationships can be as follows: Works_in : employee works ina department Has_acquired: employee has acquired a skill Assigned_to : employee assigned to a project Controlled_by: A project is controlled by a department Project_manager : Employee is a project_manager of a Project.
4. Consider a movie database, with nodes as Actors, Movies, Roles,Producer, Financier, Director. Assume appropriate relationships between the nodes, include properties for nodesand relationships.
Create a Social network database, with labels as Person, Affiliations, Groups, Story, Timeline etc. Some of the relationshipscan be as follows: Person→[friend of]→Person→[affiliated to]→affiliations Person→[belongs to]→Groups, Person→[create]→Story→[refers to] →Person Person→[creates]→Timeline→[reference for]→Story , Timeline→[contains]→Messages

Computer Science Database Technologies: Neo4j PracticalAssignment 2
Simple Queries.

1. Library Database:

a) List all people, who have issued a book "……"
b) Count the number of people who have read " …."
c) Adda property "Number of books issued " for Mr. Joshi and set its valueas the count
d) List the names of publishers from Pune city.

2. Song Database:

a) List the names of songs written by ":….."
b) List the names of record companies who have financed for the song"…."
c) List the names of artist performing the song "….."
d) Namethe songs recorded by the studio " ……."

3. **Employee Database:**

a) List the names of employees in department" "
b) List the projects along with their properties, controlled by department "……"
c) List the departments along with the count ofemployees in it
d) List the skillset for an employee " ..... "

4. **Movie Database:**

a) Find all actors who have acted in a movie " "
b) Find all reviewer pairs, one following the other and both reviewing the same movie, and return entire subgraphs.
c) Find all actors that acted in a movie together after 2010 and return the actornames and movie node
d) Find all movies produced by "....."

5. **Social Network Database:**

a) Find all friends of "John", along with the year, since when john knows them. b) List out the affiliations of John.
c) Find all friends of john, who are born in thesame year as John
d) List out the messages posted by John in his timeline, during the year 2015.

Computer Science Database Technologies: Neo4jAssignment 3
Complex pattern Queries:

1. Library database

a) List all readers whohave recommended either book "…" or "……." or " ....."
b) List the readers who haven't recommended any book
c) List the authors who have written a book that has been read / issued by maximum number of readers.
d) List the names of books recommended by"....." And read by at least one reader
e) List the names of books recommended by " ..... " and read by maximum number of readers.
f) List the names of publishers who haven't published anybooks written by

authors from Pune and Mumbai.
g) List the namesof voracious readers in our library

2. Song Database:

a) List the names of artists who have sung onlysongs written by " "
b) List the names of artists who have sung the maximum number of songs recorded by "……" studio
c)List the names of songs financed by "…..", and sung by " "

3. Employee Database:

a) List the names of employees having the same skills as employee " "
b) List the projects controlled by a department " " and have employees of the same department working in it.
c) List the names of the projects belonging todepartments managed by employee

4. **Movie Database:**

a) List the names of actors that paired in multiplemovies together.
b) List all pairs of actor–movie subgraphs along with the roles played.
c) List all reviewers and the ones they are following directly or via another a third Reviewer.
d) List the names of movies that have the most number of reviews.

5. Social Network Database:

a) List out the people, who have created maximum timeline messages.
b) List all friends of John's friend, Tom
c) List the people with maximum friends
d) List the people who are part of more than 3 groups.

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Semester –I	**Paper -VI**
Course Code: MSC-CS 116 P	**Title of the Course : Project**
Credits: 02	**Total Lectures: 60 Hrs**

MSC-CS 116P :-**Project**

The Project can be platform, Language and technology independent. Project will be evaluated by project guide. Assessment will be done weekly in the respective batch. Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration. You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. report should sharply focus how much time you have spent on specific task.

SN	From Date To Date	Details of Project work

Head,
Dept. of Computer Science

Project Guideline:

Students should prepare design document using SE/UML techniques depends on yourproject • Project Report Contents should be as follows:

1. College certificate
2. Acknowledgement
3. Problem Definition
4. Existing System and need for the new system
5. Scope of the work
6. Feasibility study (Including H/W & S/W setup requirements)
7. Requirement Analysis (including fact finding methods used)
8. E-R diagrams
9. Decision trees/Decision tables
10. Normalized Database Design & Data Dictionary.
11. Data flow Diagrams (if applicable)
12. Use-case Diagrams
13. Class Diagrams
14. Object Diagrams
15. Sequence Diagrams
16. Collaboration Diagram
17. Activity Diagram
18. State Chart (if applicable)
19. Component Diagram
20. Deployment Diagram (if applicable)
21. User interface design Menus Input Screens using sample data Reports, Graphs using sample data
22. Testing & Implementation plan (Should contain testing strategies, techniques used & implementation approach used.)
23. User manual
24. Drawbacks, Limitations & Proposed enhancement
25. Abbreviations used (if any)
26. Bibliography/Reference (Including book titles, authors name, editions, publications, etc.)

Project Related Assignments:

Assignment 1

Assignment 2

Assignment 3

Assignment 4

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Semester –I	**Paper -VI**
Course Code: MSC-CS 117 T(A)	**Title of the Course :** Artificial Intelligence
Credits: 02	**Total Lectures:** 30 Hrs.

Course Outcomes (Cos):

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning

Unit	**Course Contents**	**Allotted Hours**
Unit I	**Introduction to Artificial Intelligence:** Introduction and Intelligent systems, What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, Applications of AI, Early work inAI and related fields, AI problems and Techniques.	**(01)**
Unit II	**Searching:** Defining AI problems as a State Space Search: example, Search and Control Strategies, Problem Characteristics, Issues in Design of Search Programs, Production System.Blind Search Techniques: -BFS, DFS, DLS, Iterative Deepening, Search, Bidirectional Search, Uniform cost Search. Heuristic search techniques: -Generate and test, Hill Climbing, Best First search, Constraint Satisfaction,Mean-End Analysis, A*,AO*.	**(05)**
Unit III	**Knowledge Representation:** Representations and Mappings, Approaches to Knowledge	**(09)**

Representation, Knowledge representation method, Propositional Logic, Predicate logic, Representing Simple facts in Logic, Resolution, Forwardand backward chaining. Knowledge Representation Structure-Weak Structures, Strong Structures. Semantic Networks, Frames, Conceptual Dependencies, Scripts Game Playing- Minimax Search Procedures, Addingalpha-beta cutoffs

Unit IV **Introduction to AI with Python:** **(10)**

Introduction to Python , why python with AI, Features ofPython, Basics of Python, Python statements, Methods &Functions using python, Basic and advanced modules &Packages, Python Decorators and generators .Advanced Objects & Data structures.

Unit V **Machine Learning:** **(05)**

Why Machine learning, Types of Machine Learning:Supervised learning- Classification & Regression. Decision tree, Random Forest, KNN, Logistic algorithms.Unsupervised learning-Clustering & Association. K- means for clustering, Apriori algorithm. Support Vector Machine (SVM),Reinforcement learning.

Suggested Readings:

Sr. No.	Title of the Book	Author/s	Author/s
1	Computational Intelligence	Eberhart	Elsevier Publication
2	Artificial Intelligence: A New Synthesis	Nilsson	Elsevier Publication
3	Artificial Intelligence with Python	PrateekJoshi	Packt Publishing Ltd
4	Reinforcement and Systematic Machine Learning for Decision Making,	Parag Kulkarni	Wiley-IEEE Press Edition
5	Artificial Intelligence	Saroj Kausik	Cengage Learning
6	Introduction to Machine Learning	EthemAlpaydin	PHI 2nd Edition

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Semester –I	**Paper -VIII**
Course Code: MSC-CS 118 P(A)	**Title of the Course:** Artificial Intelligence **Practical**
Credits: 02	**Total Lectures: 60 Hrs**

Course Outcomes (Cos):

- learn various types of algorithms useful in Artificial Intelligence (AI).
- convey the ideas in AI research and programming language related to emerging technology.
- understand the numerous applications and huge possibilities in the field of AI that goes beyond the normal human imagination.

Sr.no	**Course Contents :Artificial Intelligence PracticalAssignment**
1.	Subject teacher should conduct first lab practical on basic programs using python for introducing and using python environment such as, a) Program to print multiplication table for given no. b) Program tocheck whether the given no is prime or not. c) Program to find factorial of the given no and similar programs.
2.	Write a program to implement List Operations (Nested list, Length, Concatenation, Membership, Iteration, Indexing and Slicing), ListMethods(Add, Append, Extend & Delete)
3.	Write a program to Illustrate Different Set Operations.
4.	Write a program to implement Simple Chatbot.
5.	Write a program to implement Breadth First Search Traversal.
6.	Write a program to implement Depth First Search Traversal.
7.	Write a program to implement Water Jug Problem.
8.	Write a program to implement K -Nearest Neighbor algorithm.
9.	Write a program to implement Regression algorithm.
10.	Write a program to implement Random Forest Algorithm.

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Semester –I	**Paper -VIII**
Course Code: MSC-CS 117 T(B)	**Title of the Course : Cloud Computing**
Credits: 02	**Total Lectures: 30 Hrs**

Course Objectives:

- To understand the principles and paradigm of CloudComputing
- To appreciate the role of Virtualization Technologies
- Ability to design and deploy Cloud Infrastructure
- Understand cloud security issues and solutions

UNIT	Course Contents	Allocated Hours
Unit I	**Introduction to Cloud Computing** Overview, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.	**(06)**
Unit II	**Architecture, Services and Applications** Exploring the Cloud Computing Stack,Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frameworks, Software asa Service Cloud Deployment Models, Public vsPrivate Cloud, Cloud Solutions, Cloud ecosystem,Service management, Computing on demand, Identity as a Service, Compliance as a Service Future of cloud computing and Emerging trends.	**(06)**

Unit III	**Abstraction and Virtualization** Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Center Automation	**(05)**
Unit IV	**Programming, Environments and Applications** Features of Cloud and Grid Platforms,Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments,Understanding Core OpenStack Ecosystem.Applications: Moving application to cloud,Microsoft Cloud Services, Google CloudApplications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, OfficeServices, Google Apps, Customer Relationship Management).	**(06)**
Unit V	**Security in The Cloud** Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security. Autonomic Security Storage Area Networks, Disaster Recovery in Clouds.	**(07)**

Suggested Readings:

Sr. No.	Title of the Book	Authors	Publication
1	Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center	Brian J.S. Chee andCurtis Franklin	CRC Press, ISBN :9781439806128
2	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi	Mastering Cloud Computing: Foundations and Applications Programming	McGraw Hill, ISBN: 978 1259029950, 1259029956
3	Kai Hwang, Geoffrey C Fox, Jack G Dongarra	Distributed and Cloud Computing, From Parallel Processing to the Internet of Things	Morgan Kaufmann Publishers, 2012.

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Semester –I	**Paper –VIII**
Course Code: MSC-CS117 P(B)	**Title of the Course : Cloud Computing Practical**
Credits: 02	**Total Lectures:60 Hrs.**

Course Objectives:

- articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for cloud computing
- explain the core issues of cloud computing such as security, privacy, and interoperability.
- identify problems, and analyze, evaluate various cloud computing solutions according to the applications used.
- Create and deploy a cloud using google, Amazon, cloud platform.

Sr. No	**Assignment**
1.	Working and Implementation of Infrastructure as a service.
2.	Working and Implementation of Software as a service.
3.	Working and Implementation of Platform as a services.
4.	Practical Implementation of Storage as a Service.
5.	Working of Google drive to make spreadsheet and notes.
6.	Working and Implementation of identity management.
7.	Write a program for web feed.
8.	Execute the step to Demonstrate and implementation of cloud on single sign on.
9.	Practical Implementation of cloud security.
10.	Installing and Developing Application Using Google App Engine.
11.	Implement VMWAreESXi Server
12.	Using OpenNebula to manage heterogeneous distributed data center Infrastructure.
13.	Implementation of Cloud Failure Cluster.
14.	Managing and working of cloud Xen server.
15.	Working with Aneka and demonstrate how to Managing cloud computing Resources .

16.	Installation and configuration of cloud Hadoop and demonstrate simple query.
17.	Create a sample mobile application using Amazon Web Service (AWS) account as a cloud service. Also provide database connectivity with implemented mobile application.

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Semester –I	**Paper –IX**
Course Code: MSC-CS 119 T	**Title of the Course : Research Methodology**
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes:

Upon completing this course, each student will be able to:

• demonstrate knowledge of research processes (reading, evaluating and developing)

• Prepare intellectual framework necessary to explore wide spectrum of research areas

• perform literature reviews.

• identify, explain, compare, and prepare the key elements of a research proposal/report.

• The qualitative as well as quantitative methods of research will help bridge the gap between theory and Practice.

Unit	**Course Contents**	**Allotted Hours**
Unit I	**Purpose and Products of Research 6 lectures** 1.1 Information Systems and Computing disciplines 1.2 Possible products and outcomes of research 1.3 Finding and choosing research topics 1.4 Evaluating the purpose and products of research	**(10)**
Unit II	**Research Process** 2.1 Model of research process 2.2 Evaluating the research process	**(05)**
Unit III	**The Internet Research, Participants and Research Ethics** 3.1 Internet research topics 3.2 Literature review on the Internet 3.3 The Internet and research strategies and methods 3.4 Internet research, the law and ethics 3.5 Rights of people directly involved 3.6 Responsibilities of an ethical Researcher 3.7 Design and creation projects and ethics 3.8 Evaluating research ethics	**(10)**

Unit IV Literature Review **(05)**

4.1 Purpose of literature review
4.2 Literature resources
4.3 The Internet and literature reviews
4.4 Conducting and evaluating literature review

Suggested Readings:

Sr. No.	Title of the Book	Author/s	Publication
1	Researching Information Systems and Computing	by Briony J. Oastes Sage	India Pvt. Ltd., New delhi ISBN 1-4129-0224-X (pbk)
2	Your research Project, A Step by step Guide for the first-time researcher	by Nicholas Walliman, Vistaar	A division of Sage Publications), New Delhi ISBN 81-7829- 540-7
3.	Research Methods	by William M K Trochim Co	

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Semester –II	**Paper -I**
Course Code: MSC-CS 211T	**Title of the Course :** Advanced Operating System
Credits: 04	**Total Lectures: 60 Hrs**

Course Outcomes:

- This course teaches Advanced Operating Systems Concepts using Unix/Linux. This course strikes a delicate balance between theory and practical applications In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program.
- This course describes the programming interface to the Unix/Linux system - the system call interface.
- It is intended for anyone writing C programs that run under Unix/Linux.
- This course provides an understanding of the functions of Operating Systems. It also provides an insight into functional modules of Operating Systems. It discusses the concepts underlying in the design and implementation of Operating Systems

UNIT	Course Contents	Allotted Hours
Unit I	Microprocessor and Introduction to UNIX/Linux Kernel 1.1 Introduction,Objectives,Multiprocessing and Processor Coupling 1.2 Multiprocessor Interconnections- Bus-oriented System, Crossbar-Connected System, Hypercubes System, Multistage Switch-Based System. 1.3 Types of Multiprocessor Operating Systems – Separate Supervisors, Master-Slave, Symmetric 1.4 Multiprocessor Operating System Functions and	(12)

	Requirements 1.5 Multiprocessor Synchronization – Test and Set, Compare and Swap, Fetch and Add 1.6 System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System 1.7 Concepts of Linux Programming- Files and the File system, Processes, Users and Groups, Permissions, Signals, Inter process Communication	
Unit II	File and Directory I/O 2.1 The Buffer Cache: Buffer header, structure of buffer pool, scenario of retrieval of buffer, reading and writing disk blocks, Advantage and Disadvantage of buffer cache. 2.2 Internal representation of files: Inode, Structure of regular file, Allocation of disk blocks. 2.3 System calls for the file System: Open: read,write files and record locking, Adjusting the position of file I/O, Lseek, close, file creation, creation of special files, changing the directory, root, owner,mode-stat,fstat, pipes, dup, mounting and unmounting file systems, link and unlink.	(08)
Unit III	Process Environment, Process Control and Process Relationships Process states and transitions, Layout of system memory, The context of a process, saving the context of the process, manipulation of process address space, sleep, process control, process creation, process termination, awating process termination, invoking other programs, user id of process, changing the size of process , shell- system boot and INIT process, process scheduling.	(10)

Unit IV	Memory Management The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation Swapping, Demand Paging	(08)
Unit V	Signal Handling Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited, sleep	(10)
Unit VI	Programming GNOME Using GTK programming GNOME,GNOME architecture desktop, Programming in GNOME using GTK+,GTK+GNOME libraries, glib,GTK+ GNOME basic.	(12)

Suggested Readings:

1. Maurice J. Bach, “The Design of the Unix Operating System”, Pearson Education.
2. A.Robbins, Linux Programming by Example: The Fundamentals, Pearson Education, 2008.
3. GTK+/Gnome Application Development - Havoc Pennington

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Syllabus of M. Sc. Computer Science
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Semester –II	**Paper –II**
Course Code: MSC-CS 212 T	**Title of the Course :** Information System Security
Credits: 04	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

- Understand the conceptual foundation of information security awareness.
- Analysis the risk events, treatment plans, assessment
- Detail evaluation of information classification, roles and Responsibilities
- Examining the access controls, monitoring, management and review process.
- Study the physical and logical perimeters of information assets and its security

Sr.No	Course Contents	Allotted Hours
Unit I	**Foundation of Information Systems Security** 1.1 Concepts and Terminology 1.1.1 Threats 1.1.2 Vulnerabilities 1.2 Risk, Risk Assessment and Mitigation, 1.3 Security and Principles of Information Security 1.3.1 Confidentiality, Integrity, Availability,Identification, Authentication, Authorization, Accountability, Privacy	**(08)**
Unit II	**Data Encryption Technique** 2.1 Introduction to Plain Text and Cipher Text 2.2 Substitution Techniques 2.2.1 Caeser Cipher 2.2.2 Mono alphabetic cipher 2.2.3 Polyalphabetic Cipher 2.2.4 Playfair 2.2.5 Hill Cipher 2. 3 Transposition Techniques 2.3.1 Reil Fence Technique 2.3.2 Simple Columnar	**(12)**

	2.3.3 Vernam Cipher 2.3.4 Book Cipher 2.4 Encryption and Decryption 2.5 Steganography	
Unit III	**Symmetric and Asymmetric Cryptographic Techniques** 3.1 Overview of Symmetric/Secret Key Cryptography 3.1.1 Symmetric Encryption Algorithm 3.1.1.1 DES algorithm 3.1.1.2 AES algorithm 3.1.1.3 IDEA 3.1.1.4 Blowfish 3.1.1.5 RC5 3.2 Overview of Symmetric/Secret Key Cryptography 3.2.1 Asymmetric Encryption Algorithm 3.2.1.1 RSA algorithm 3.3 Difference between Symmetric and Asymmetric Cryptography	**(12)**
Unit IV	**Authentication and Digital Signatures** 4.1 Overview of Digital Signature 4.2 Study of Digital Signature Authentication Process 4.2.1 Authentication Techniques 4.2.1.1 Passwords 4.2.1.2 Authentication Tokens 4.2.1.3 Biometric Authentication 4.3 Use of Cryptography for authentication 4.4 Secure Hash function, Key management 4.5 Kerberos	**(09)**
Unit V	**Internet Security protocols** 5.1 Security protocols 5.1.1 SSL/TLS 5.1.2 TSP 5.1.3 SET 5.1.4 3 – D Secure protocol 5.2 Electronic money 5.3 Email security (SMTP,PGP, PEM, S/MIME) 5.4 Wireless Application Protocol(WAP) Security 5.4 Security in GSM 5.5 Security in 3G	**(11)**
Unit VI	**Malicious Software** 6.1 Malicious Code 6.2 Viruses : types, working of anti-virus software 6.3 Worms 6.4 Types of Malware 6.4.1 Trojan horse 6.4.2 Spyware 6.5 Attacks: Hoax, Back-door, Brute Force, Dictionary, Spoofing,	**(08)**

	Denial-of-service, Man-in-the-middle, spam, E-mail Bombing & Spamming, Sniffer. Timing attack. 6.6 Anatomy of Attack 6.6.1 Attack Prevention Tools and Techniques 6.6.2 Intrusion Detection Tools and Techniques	

Suggested Readings:

1. Atul Kahate, "Cryptography and Network Security" TMH
2. William Stallings," Cryptography and Network Security" Prentice Hall /Pearson Education
3. Cryptography and Information Security By V.K. Pachghare (PHI Learning Private Limited)
4. Introduction to Computer Security By Matt Bishop and Sathyanarayana (PEARSON EDUCATION)
5. Applied Cryptography Protocols, Algorithms, and Source Code in C By Bruice Schneier(Wiley India)
6. A Classical Introduction to Cryptography Exercise Book, Baigneres, Springer,

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Semester –II	**Paper -III**
Course Code: MSC-CS 213 T	**Title of the Course :** Mobile Technologies
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes:

- To impart basic understanding of the wireless communication systems.
- To design and implement the user interface for mobile applications.
- To understand the issues relating to Wireless applications.
- To study the cellular architecture of GSM, GPRS,CDMA.

Unit	Course Contents	Allotted Hours
Unit I	**Origination of Mobile Computing** 1.1 Introduction and need of Mobile Computing 1.2 Cellular Technologies (GSM, GPRS, CDMA) 1.3 Introduction and need for Mobile computing 1.4 Mobility and portability 1.5 Mobile and Wireless devices 1.6 Mobile Applications 1.7 Mobile Operating system – IOS, BlackBery, Windows phone, Palm OS, Symbian OS, PhoneGap	(04)
Unit II	**Introduction to Android** 2.1 Overview and evolution of Android 2.2 Why Android? 2.2 Features of Android, Android architecture 2.3 Application of Android, Manifest file 2.4 Android Activity 2.5 Service Lifecycle	(06)
Unit III	**1.Designing of User Interface using Android** 1.1 Basic UI Design (Form widgets ,Text Fields , Layouts , [dip, dp, sip, sp] versus px) 1.2 Intent(in detail) 1.3 Components (e.g Button , Slider, Image view, Toast) Event Handling 1.4 Adapters and Widgets 1.5 Menu	(06)

	2.Threads and Notifications of Android 2.1 Threads running on UI (runOnUiThread) 2.2 Worker thread 2.3 Handlers & Runnable 2.4 Async Task (in detail) 2.5 Broadcast Receivers 2.6 Services and notifications 2.7 Toast 2.8 Alarms	(06)
Unit IV	**Advanced Android** 4.1 SQLite Programming 4.2 JSON Parsing Accessing 4.3 Accessing Phone Service(Call, SMS, MMS) 4.4 Location based services	(05)
Unit V	**IOS Fundamentals** 5.1 What is IOS, Architecture, Features. 5.2 Introduction to Swift (General Concept of Swift) 5.3 Introduction to Xcode	(03)

Suggested Readings:

1. Beginning Android Application Development by Wei-Meng Lee Wiley
2. Mobile Computing by Raj Kamal
3. Android 4 Application Development byReto Meier

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Semester –II	**Paper -IV**
Course Code: MSC-CS 214 P	**Title of the Course:** Advanced Operating System Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- Learn Advanced Operating Systems Concepts using Unix/Linux and Windows as representative examples.
- This course describes the programming interface to the Unix/Linux system - the system call interface.
- It concludes with an overview of Windows Threads Management, an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems.

Sr. No	
1.	To create 'n' children. When the children will terminate, display total cumulative time children spent in user and kernel mode
2.	To generate parent process to write unnamed pipe and will read from it.
3.	To create a file with hole in it.
4.	Takes multiple files as Command Line Arguments and print their inode number
5.	To handle the two-way communication between parent and child using pipe
6.	Print the type of file where file name accepted through Command Line
7.	To demonstrate the use of at exit() function
8.	Open a file goes to sleep for 15 seconds before terminating
9.	To print the size of the file
10.	Read the current directory and display the name of the files, no of files in current directory.
11.	Write a C program to implement the following unix/linux command (use fork, pipe and exec

	system call)ls –l | wc –l
12.	Write a C program to display all the files from current directory which are created in particular rmonth
13.	Write a C program to display all the files from current directory whose size is greater that n Bytes where n is accept from user.
14.	Write a C program to implement the following unix/linux command i. ls –l > output.txt
15.	Write a C program which display the information of a given file similar to given by the unix / linux command ls –l <file name>
16.	Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should additionally interpret the following command. i) count c <filename> - print number of characters in file ii) count w <filename> - print number of words in file iii) count l <filename> - print number of lines in file
17.	Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should additionally interpret the following command. i) list f <dirname> - print name of all files in directory ii) list n <dirname> - print number of all entries iii) list i<dirname> - print name and inode of all files
18.	Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell$". Any normal shell command is executed from your shell by starting a child process to execute the system program corresponding to the command. It should additionally interpret the following command i) typeline +10 <filename> - print first 10 lines of file ii) typeline -20 <filename> - print last 20 lines of file iii) typeline a <filename> - print all lines of file
19.	Write a C program that behaves like a shell (command interpreter). It has its own prompt say "NewShell$".Any normal shell command is executed from your shell by starting a child process

	to execute the system program corresponding to the command. It should i) additionally interpret the following command. ii) search f <pattern> <filename> - search first occurrence of pattern in filename iii) search c <pattern> <filename> - count no. of occurrences of pattern in filename iv) search a <pattern> <filename> - search all occurrences of pattern in filename
20.	Write a C program which receives file names as command line arguments and display those filenames in ascending order according to their sizes.i) (e.g $ a.out a.txt b.txt c.txt, …)
21.	Write a C program which create a child process which catch a signal sighup, sigint and sigquit. The Parent process send a sighup or sigint signal after every 3 seconds, at the end of 30 second parent send sigquit signal to child and child terminates my displaying message "My DADDY has Killed me!!!".
22.	Write a C program to implement the following unix/linux command (use fork, pipe and exec system call). Your program should block the signal Ctrl-C and Ctrl-\ signal during the execution. i. ls –l | wc –l
23.	Write a C Program that demonstrates redirection of standard output to a file.
24.	Write a program that illustrates how to execute two commands concurrently with a pipe
25.	Write a C program that illustrates suspending and resuming processes using signals
26.	Write a C program that illustrates inters process communication using shared memory
27.	Write a C program to simulate the MVT and MFT memory management techniques
28.	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical
29.	Write a C program to simulate paging technique of memory management
30.	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit
31.	GTK applications

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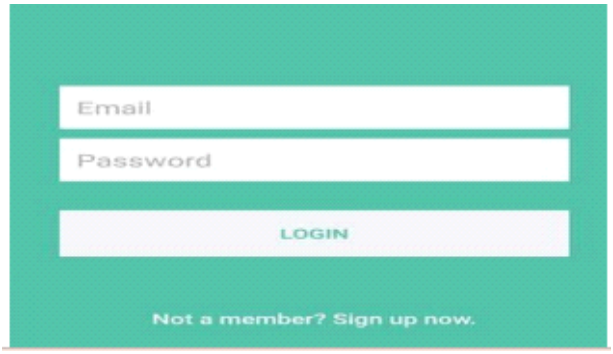
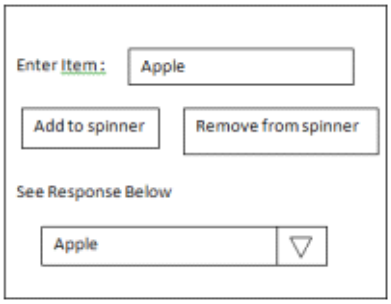
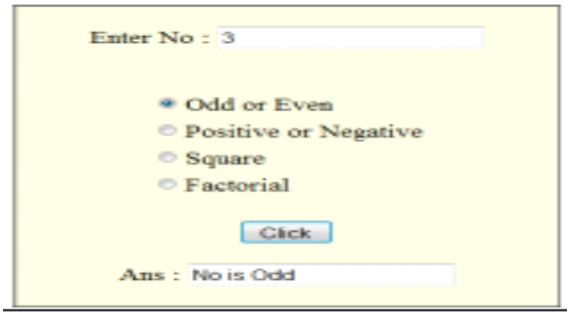
Semester –II	**Paper -V**
Course Code: MSC-CS 215 P	**Title of the Course :** Mobile Technologies Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- Apply the fundamental design paradigms and technologies to mobile computing applications.
- Develop consumer and enterprise mobile applications using representative mobile devices and platforms using modern development methodologies.
- Design effective mobile interfaces using human computer interaction principles.

Sr. No.	**Assignments**
1	Java Android Program to demonstrate login form with validation. 
2	Java Android Program to demonstrate Registration form with validation.
3	Java Android Program to send email with attachment.
4	Develop a native calculator application.
5	By using Spinner, Buttons. Write a program to draw following GUI.

	
6	Create an Android application, which show to the user 5-10 quiz questions. All questions have 4 possible options and one right option exactly. Application counts and shows to the user how many right answers were right and shows the result to user.
7	Write a program to search a specific location on Google Map.
8	Perform following numeric operation according to user selection of radio button 
9	Design an android application for menu.
10	SMS Sending –Message can be sent using 2 methods – using Intent, using SMS Manager ms Sending –Message can be sent using 2 methods – using Intent, using SMS Manager SMS Sending –Message can be sent using 2 methods – using Intent, using SMS Manager SMS Sending –Message can be sent using 2 methods using Intent, using SMS Manager.
11	Implement an application that creates an alert upon receiving a message.
12	Create table Customer (id, name, address, phno). Create Application for Performing the following operation on the table. (using SQLite database i) Insert New Customer Details. ii) Show All the Customer Details
13	Implement the concept of Async Task in Android App.
14	Create table Customer (id, name, address, phno).

	Create Application for Performing the following operation on the table. (using sqlite database) i) Insert New Customer Details. ii) Show All the Customer Details
15	Create table Customer (id, name, address, phno). Create Application for Performing the following operation on the table. (using sqlite database) i) Insert New Customer Details. ii) Show All the Customer Details

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Semester –II	**Paper -VI**
Course Code: MSC-CS 216 P	**Title of the Course :** Introduction to System Security Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes (COs):

- Understand and explain the risks faced by computer systems and networks.
- Identify and analyze security problems in computer systems and networks.
- Explain how standard security mechanisms work.
- Develop security mechanisms to protect computer systems and networks.
- Use cryptography algorithms and protocols to achieve computer security.

Sr. No.	**Assignments**
01	Implement Ceaser Cipher
02	Implement Affine Cipher with equation c=3x+12
03	Implement Playfair Cipher with key entered by user.
04	Implement polyalphabetic Cipher
05	Implement AutoKey Cipher
06	Implement Hill Cipher.
07	Implement Rail fence technique
08	Implement Simple Columner Transposition technique
09	Implement Advanced Columner Transposition technique.
10	Implement Simple RSA Algorithm with small numbers.
11	Implement Simplified DES
12	Make a study of one IDS (For ex. Snort)

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Semester –II	**Paper -VII**
Course Code: MSC-CS 217 T(A)	**Title of the Course : DOT NET**
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes:

- Students will able to learn c# fundamentals
- Students develop web-sites using .NET framework
- Develop the console and GUI applications using C# .Net.

Unit	Course Contents	Allotted Hours
Unit I	**DOTNET Framework** 1.1 Introduction to DOTNET 1.2 DOT NET class framework 1.3 Common Language Runtime Overview 1.4 Elements of .NET application 1.5 Memory Management 1.6 Garbage Collector : Faster Memory allocation, Optimizations 1.7 Common Language Integration 1.8 Common type system 1.9 Reflection API 1.10 User and Program Interface	**(04)**
Unit II	**Introduction to C#** 2.1 Language features 2.1.1 Variables and Expressions, type conversion 2.1.2 Flow Control 2.1.3 Functions, Delegates 2.1.4 Debugging and error handling, exception handling(System Defined and User Defined) 2.2 Object Oriented Concepts 2.2.1 Defining classes, class members, Interfaces, properties 2.2.2 Access modifiers, Implementation of class, interfaceand properties 2.2.3 Concept of hiding base class methods, Overriding 2.2.4 Event Handling	**(04)**

	2.3 Collections, Comparisons and Conversions 2.3.1 Defining and using collections, 2.3.2 Indexers, iterators 2.3.3 Type comparison, Value Comparison 2.3.4 Overloading Conversion operators, as operator 2.4 Generics 2.4.1 Using generics Defining Generics, generic Interfaces,Generic methods, Generic Delegate	
Unit III	**Window Programming** 3.1 Window Controls 3.1.1 Common Controls 3.1.2 Container Controls 3.1.3 Menus and Toolbars 3.1.4 Printing 3.1.5 Dialogs 3.2 Deploying Window Application 3.2.1 Deployment Overview 3.2.2 Visual studio setup and Deployment project types 3.2.3 Microsoft windows installer architectureBuilding the project :Installation	**(06)**
Unit IV	**Data Access** 4.1 File System Data 4.2.XML 4.3 Databases and ADO.NET Data Binding	**(03)**
Unit V	**Web Programming** 5.1 Basic Web programming 5.2 Advanced Web programming 5.3 Web Services Deployment Web applications	**(03)**
Unit VI	**.NET Assemblies** 6.1 Components 6.2 .NET Assembly features 6.3 Structure of Assemble, Calling assemblies, private and shared assemblies	**(05)**
Unit VII	**Networking** 7.1 Networking overview 7.2 Networking programming options 7.2.1 Webclient 7.2.2 WebRequest and WebResponse 7.2.3 TcpListener &TcpClient	**(05)**

Suggested Readings:

1. Beginning Visual C#, Wrox Publication
2. Professional Visual C#, Wrox Publication
3. Beginning ASP.NET 3.5, Wrox Publication

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Semester –II	Paper -VIII
Course Code: MSC-CS 218 P(A)	**Title of the Course :** DOT Net Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

At the end of this Lab course students will be able to:

- Create simple data binding applications using ADO.Net connectivity.
- Performing Database operations for Windows Form and web applications.

Sr. No	Assignments
1.	Program to display the addition, subtraction, multiplication and division twn umber usingconsole application.
2.	Program to display the addition using thewindows application.
3.	Write a program to convert input string from lower to upper and upper to lower case.
4.	Write a program to simple calculator usingwindows application.
5.	Write a program to connectivity with Oracledatabase.
6.	Write a program to access data source through ADO.NET.
7.	Write a program to manage the session.
8.	Write a Program to perform validation operation.
9.	Write a Program to display the phone no of anauthor using database.
10.	Write a Program to display how data bind using dropdown list.
11.	Write a Program to insert the data in to databaseusing Execute-Non Query.
12.	Write a Program to delete the data in to databaseusing Execute non-query.
13.	Write a Program to bind data using data grid.
14.	Write a Program to bind data using Hyperlinkcolumn in data grid.
15.	Write a Program to bind data using button columnin data grid.
16.	Write a Program create an own table and binddata using data grid.
17.	Write a Program to bind data using template indata list

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Semester –II	**Paper –VII**
Course Code: : MSC-CS 217 T(B)	**Title of the Course :** Soft Computing
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes:

- To introduce the ideas of soft computational techniques based on human experience.
- To generate an ability to design, analyze and perform experimentson real life problems using various Neural Learning Algorithms.
- To conceptualize fuzzy logic and its implementation for variousreal world applications.
- To apply the process of approximate reasoning using Neuro-Fuzzy Modeling.
- To provide the mathematical background to carry out optimization using genetic algorithms

Unit	Course Contents	Allotted Hours
Unit I	**Introduction to Soft Computing** 1.1 Neural Networks 1.1.1 Definition, Need, Advantages 1.1.2 Applications 1.1.3 Scope 1.2. Fuzzy logic 1.2.1 Definition 1.2.2 Applications 1.3 Genetic Algorithms 1.3.1 Definition 1.3.2 Applications	(03)
Unit II	**Neural Network** 2.1 Fundamental Concept 2.1.1 Artificial Neural Network 2.1.2 Biological Neural Network 2.2 Brain vs. Computer 2.3 Comparison Between Biological Neuron and Artificial Neuron 2.4 Neural Networks Architecture 2.4.1 Feed forward network 2.4.2 Feedback network 2.9 Salient Properties of Neural Networks 2.10 Geometry of Binary Threshold Neurons and	(13)

	TheirNetworks 2.10.1 Pattern Recognition and Data Classification 2.10.2 Convex Sets 2.10.3 Convex Hulls and Linear Seperability, 2.10.4 Space of Boolean Functions 2.10.5 BinaryNeurons are Pattern Dichotomizes 2.11 Non-linearlySeparable Problems 2.11.1 Capacity of a Simple ThresholdLogic 2.11.2 Neuron, Revisiting the XOR Problem 2.11.3 Multilayer Networks 2.11.4 How Many Hidden Nodes are Enough? 2.12 Learning and Memory 2.12.1 An Anecodatal Introduction 2.12.2 Long Term Memory 2.12.3 The Behavioral Approach to Learning 2.12.4The Molecular Problem of Memory 2.13 Learning Algorithms 2.13.1 Error Correction and Gradient Descent Rules 2.13.2 Learning Objective for TLNs 2.13.3 Pattern Space and Weight Space 2.13.4 Linear Seperability 2.13.5 Hebb Network 2.13.6 Perceptron Network. 2.13.7 α- Least Mean Square Learning	
Unit III	**3.Fuzzy Set Theory** 3.1 Brief Review of Conventional Set Theory 3.2 Introduction to Fuzzy Sets 3.3 Properties of Fuzzy Sets 3.4 Operations on Fuzzy Sets 3.4.1 Crisp Relation 3.4.2Fuzzy Relation 3.4.3 Tolerance and equivalence relation 3.4.4 Fuzzy Tolerance and equivalence relation, 3.4.5 Fuzzy Max-Min and Max-Product Composition 3.5 Membership Functions 3.5.1Fuzzification, Defuzzification to crisp sets 3.5.2 λ-Cuts for fuzzy Relations 3.5.3 Fuzzy (Ruled-Based) system 3.5.4 Graphical technique of inference 3.5.5 Membershipvalueassignment 3.5.6 Intuition,Inference. 3.6 Fuzzy Classification 3.6.1 Classification by equivalence relation 3.6.2 Cluster analysis	(10)

	3.6.3 Cluster validity 3.6.4 C-Means clustering 3.6.5 Hard c-means 3.6.6 Fuzzy c-Means 3.6.7 Fuzzy Arithmetic	
Unit IV	**Genetic Algorithms** 4.1 What are Genetic Algorithms? 4.2 Why Genetic Algorithms? 4.3 Biological Background 4.3.1The Cell 4.3.2Chromosomes 4.3.3Genetics 4.3.4Reproduction 4.3.5 NaturalSelection 4.4Genetic Modeling 4.4.1Cross over, 4.4.2Inversion & Deletion 4.4.3Mutation Operator 4.4.4Bit-wise Operators	(04)

Suggested Readings:

1.Fuzzy Logic With Engineering Timothy Ross Wiley Publication
2.Introduction to Soft Computing Deepa & Shivanandan Wiley Publication
3. Genetic Algorithms in Search, Optimization and Machine Learning David E. Goldberg Pearson Education
4. Fundamentals of Neural Networks – Architectures, Algorithms, And Applications Laurene Fausett Pearson Education
5. Neural Networks Satish Kumar Tata McGrawHill

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Semester –II	Paper –VIII
Course Code: : MSC-CS 218 P(B)	**Title of the Course :** Soft Computing Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- Implement the Fuzzy logic Operations.
- Implement the Soft Computing Concepts.
- Implement the Perceptron Model.
- Implement supervised learning algorithm.

Implement the programs in C/C++/Java/Python/MATLAB

Sr. No	Assignment
1.	Write a program to implement Fuzzy Operations 1.Union 2.Intersection 3.Complement 4.Algebraic sum 5.Cartesian product 6.Algebraic product
2.	Write a program to implement De-Morgan's law.
3.	Write a program to implement Max-Min Composition and Max-Product Composition.
4.	Write a program to implement lambda cut
5.	Write a program to implement Activation Function.
6.	Write a program to implement Perceptron Learning Rule
7.	Write a program to implement Hebb's Rule
8.	Write a program to implement Feed Forward Network
9.	Write a program for building an Artificial Neural Network by implementing the Back propagation Algorithm and test the same using appropriate data sets.
10.	Write a program for solving linearly separable problem using Perceptron Model.
11.	Write a program to develop Supervised Learning Algorithm.
12.	Write a program to study and analyze Genetic Life Cycle

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Semester –II	**Paper –VII**
Course Code: : MSC-CS 217 T(C)	**Title of the Course :** Network Cyber Security
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes:

- Understand the basic concepts of network security and use of firewall , VPN, Intrusion detection/prevention system in network security.
- Knowledge of how to secure web, web browser, email application and wireless network.
- Understand concepts of cyber security and use of digital signature algorithms

Unit	Course Contents	Allotted Hours
Unit 1	**Introduction to Network security** 1.1 Introduction 1.1.1 Definition 1.1.2 Need of network security 1.2 The OSI Security Architecture 1.3 Network security model 1.4 security services and mechanism 1.5 Network security attacks 1.6 Firewall 1.6.1 Definition 1.6.2 need 1.6.3 Types 1.7 VPN 1.7.1 Benefits 1.7.2 VPN authentication 1.8 Intrusion Detection system 1.9 Intrusion Prevention system	(07)

Unit 2	**Cyber Security** 2.1 Security goals 2.2 Malware 2.2.1 malware types 2.2.2 malicious software's and their effects 2.3 Cyber security principles 2.4 Security tools 2.5 Digital signature 2.6 Hashing techniques 2.6.1 MD5 and SHA-I	(06)
Unit 3	**Internet Security** 3.1 IP level security 3.1.1 Introduction 3.1.2 IPsec architecture 3.2 Transport level security 3.2.1 SSL,TLS,HTTPs, SSH 3.3 Types of internet security threats 3.4 Email security 3.4.1 PGP 3.4.2 SMIME	(05)
Unit 4	**Web Application Security** 4.1 Introduction-Need 4.2 Web application security risks 4.2 Web security 4.2.1 Web authentication 4.2.2 Injection Flaws 4.2.3 SQL Injection 4.3 Web Browser security 4.4 E-commerce security 4.4.1 Importance 4.4.2 issues 4.4.3 protection measures	(06)
Unit 5	**Wireless Network Security** 5.1 Introduction to wireless security 5.2 Wireless LAN security 5.3 Wireless Network Components 5.4 Security issues in wireless networks 5.5 Securing a wireless network 5.6 Mobile device security	(06)

Suggested Readings:

1.Cryptography and NetworkSecurity: Principles and Practice ,6Th Edition by William Stallings
2. Network Security: The Complete Reference by Roberta Bragg

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Semester –II	**Paper –VIII**
Course Code: : MSC-CS 218 P(C)	**Title of the Course :** Network Cyber Security Lab
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- Able to learn various cyber security digital signature algorithms implementation in python
- Know about the devices and components in a wireless network, identify the features of for mobile security app and know how to setup a firewall on Operating System.
- Understand security vulnerabilities of E-Mail Application and different types of vulnerabilities for hacking a websites / Web Applications

Sr. No.	**Assignment Name**
1	Write a Python program to implement Key Generation Algorithm.
2	Write a Python program to implement signing Algorithm.
3	Write a Python program to implement Signature Verifying Algorithm.
4	Write a Python program to implement Hashing technique-MD5.
5	Write a Python program to implement Hashing technique-SHA-1
	Case Study
6	Study of different wireless network components and features of any one of the Mobile Security Apps.
7	Study of the features of firewall in providing network security and to set Firewall Security in windows.
8	Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
9	Study of different types of vulnerabilities for hacking a websites / Web Applications.
10	Analysis the security vulnerabilities of E-Mail Application.

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Semester –II	**Paper –IX**
Course Code: MSC-CS 219 T	**Title of the Course : Internet of Things (IoT)**
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes:

On successful completion of the course, learners should be able to

- Define Embedded Systems and the Internet of Things
- Apply enabling technologies for developing IoT systems
- Design simple IoT applications

Unit	**Course Contents**	**Allotted Hours**
Unit I	**Concept of Internet of Things(IoT)** •Definition, Characteristics of IoT, Trends in Adoption of IoT, •IoT Devices, IoT Devices Vs Computers, •Basic Building Blocks. •Physical Design of IoT: - Things in IoT, Interoperability of IoT Devices. •Logical Design of IoT:- IoT functional blocks, Sensors and Actuators, Need of Analog/Digital Conversion. • IoT Applications •Cloud Services: IAAS, PAAS,SAAS.	(06)
Unit II	**IoT Design Methodology** • Design Steps • Basics of IoT Networking, Networking Components, Internet Structure • IoT levels and deployment templates • IoT Communication Models and IoT Communication APIs, • Sensor Networks	(06)

	• Four pillars of IoT: M2M, SCADA,WSN, RFID	
Unit III	**IoT Protocols** • Protocol Standardization for IoT • Modbus Protocol, Zigbee Architecture. • IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa. • Transport Layer:(TCP, UDP,DCCP, SCTP)-TLS,DTLS • Session Layer: HTTP,CoAP,XMPP,AMQP, MQTT	(06)
Unit IV	**Cloud Platforms for IoT** • Introduction to Cloud Storage Models, Communication API • Cloud for IoT • Introduction to Amazon Web Services for IoT and SkyNet IoT • Messaging Platform • Introduction to RESTful Web Services -GRPC,SOAP.	(06)
Unit V	**IoT Security** • Introduction, Vulnerabilities of IoT, Security Requirements • Challengesfor Secure IoT, Threat Modeling • Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability • Security model for IoT • IoT Security TomoGraphy and Layered Attacker Model • Challenges in designingIOTapplications, Introduction to Lightweight	(06)

Suggested Readings-

1. Arshdeep Bahga,Vijay Madisetti, “Internet of Things– A hands- on approach”, Universities Press, ISBN: 0: 0996025510, 13:978-996025515
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley Publication,ISBN:978-1-119-99435-0

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Semester –III	**Paper -I**
Course Code: MSC-CS 311T	**Title of the Course:** Software Project Management
Credits: 04	**Total Lectures: 60 Hrs**

Course Outcomes:

- Identify the different project contexts and suggest an appropriate management Strategy
- Identify and describe the key phases of project management.
- Determine an appropriate project management approach through anevaluation of the business context and scope of the project.

Sr.No	**Course Contents**	**Allotted Hours**
Unit I	**Introduction to Project Management** 1.1 What is a Project? 1.1.1 What is Project management? 1.1.2 Project phases and project life cycle 1.1.3 Organizational structure 1.2 Qualities of Project Manager 1.3 Project Components 1.3.1 Project Integration Management-Project plan development and execution 1.3.2 Change controls 1.3.3 Configuration management	(08)

Unit II	**Project Scope, Time and Cost Management** 2.1 Scope Management 2.1.1 Strategic planning 2.1.2 Scope planning, definition 2.1.3 Verification and control 2.2 Time management 2.2.1 Activity planning 2.2.2 Schedule development and control 2.3 Cost Management 2.3.1 Cost estimation and Control	(09)
Unit III	**Software Quality Assurance** 3.1 Quality planning 3.2 Quality Assurance	(05)
Unit IV	**Human Resource and Communication Management** 4.1 Organizational planning 4.2 Staff acquisition 4.3 Information distribution 4.4 Reporting	(06)
Unit V	**Risk Management** 5.1 Risk and Risk Types 5.2 Risk Management Process 5.2.1 Risk Analysis 5.2.2 Risk Planning 5.2.3 Risk Monitoring 5.3 Quantification and control	(06)
Unit VI	**Procurement Management** 6.1 Solicitation 6.2 Contract administration	(05)
Unit VII	**Software Metrics** 7.1 The scope of software metrics 7.2 Software metrics data collection 7.3 Analyzing software data 7.4 Measuring size, structure, external attributes	(05)
Unit VIII	**Planning a measurement program** 8.1 What is metrics plan? 8.2 Developing goals, questions and metrics 8.3 Where and When: Mapping measures to activities 8.4 How: Measurement tools 8.5 Who: Measurers , analyst, tools revision plans	(08)
Unit IX	**Software Reliability and Quality Standards** 9.1 Software Reliability 9.1.1 Measurement and prediction 9.1.2 Resource measurement 9.1.3 Productivity, teams and tools 9.2 Quality Standards	(08)

	9.2.1 CMM 9.2.2 PSP/TSP	

Suggested Readings

1. Information Technology Project Management, 6th Edition Kathy Schwalbe ISBN-13 :9781111221751 , Cenage Learning
2. Software Metrics: A rigorous and Practical Approach by Norman E. Fenton and ShariLawrence Pfleeger, International Thomson Computer Press
3. Software Engineering: A Practioner's Approach by Roger S. Pressman ISBN: 9780071267823
4. Practical Software Metrics for Project Management and Process Improvement Robert B.Grady, Prentice hall, ISBN : 9780137203840

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Semester –III	**Paper –II**
Course Code: MSC-CS 312 T	**Title of the Course :** Machine Learning
Credits: 04	**Total Lectures: 60 Hrs.**

Course Outcomes:

Upon completing this course, each student will be able to:

- Recognize the characteristics of machine learning that make it useful to real-world problems.
- Process available data using python libraries and predict outcomes using Machine Learning algorithms to solve given problem.
- Able to estimate Machine Learning models efficiency using suitable metrics.

Unit	**Course Contents**	**Allotted Hours**
Unit I	**Introduction to Machine Learning** 1.1 Data Science, Artificial Intelligence and Machine Learning Why Learn and What is Learning, What isMachine Learning Traditional Programming Vs. Machine Learning, Machine 1.2 Learning Process, Types of Data, Key Elements of Machine Learning (Representation, Evaluation and Optimization), Dimensionality Reduction (Feature Reduction) 1.3 Descriptive and Inferential Statistics: Probability, Distribution, Distance Measures (Euclidean and Manhattan), Correlation and Regression, Hypothesis Testing. Creating our own dataset, Importing the dataset,Handling 1.4 Missing Data, Splitting the dataset into the Training setand Test set, Feature Scaling.	(07)
Unit II	**Machine Learning Models** 2.1 Type of Learning- Supervised, Unsupervised and Semi-Supervised Learning. 2.2 Components of GeneralizationError (Bias, Variance, underfitting, overfitting) 2.3 A Learning System Cycle and Design Cycle. 2.4 Metrics for evaluation viz. accuracy, scalability, squared error, precision and recall, likelihood, posterior probability. 2.5 Classification Accuracy and Performance.	(06)

Unit III	**Regression Models** **3.1** Linear Regression - Simple , Multiple, Polynomial **3.2** Non-linear Regression – DecisionTree, Support Vector, Random Forest.	(10)
Unit IV	**Classification Models** **4.1** K – Nearest Neighbors (KNN) **4.2** Logistic Regression **4.3** Naive Bayes Theorem **4.4** Support Vector Machine **4.5** Decision Forest Classification **4.6** Random Tree Classification	(10)
Unit V	**Clustering Models** **5.1** K-means **5.2** Hierarchical Clustering(Agglomerative, Divisive), Dendrogram **5.3** Selecting optimal number of clusters: Within Clusters Sum of Squares (WCSS) by Elbow Method	(08)
Unit VI	**Association Rules** **6.1** Key Terms: Support, Confidence and Lift **6.2** Apriori Algorithm	(04)
Unit VII	**Reinforcement Learning** **7.1** Upper Confidence Bound **7.2** Thompson Sampling **7.3** Q-Learning	(07)
Unit VIII	**Deep Learning** **8.1** Artificial Neural Network **8.2** Convolution Neural Network **8.3** Recurring Neural Network **8.4** Convolution Neural Network **8.5** Recurring Neural Network	(08)

Suggested Readings

1. Mitchell, Tom M. "Machine learning. WCB." (1997).
2. Rogers, Simon, and Mark Girolami. A first course in machine learning. CRC Press, 2015.
3. Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning. Vol.1. Springer, Berlin: Springer series in statistics, 2001.
4. Witten, Ian H., and Eibe Frank. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann, 2005.
5. Machine learning course material by Andrew Ng, Stanford university
6. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. Vol. 1. No. 1. Cambridge: MIT press, 1998.
7. Iba, Takashi, et al. "Learning patterns: A pattern language for active learners." Conference on Pattern Languages of Programs (PLoP). 2009.

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Semester –III	**Paper -III**
Course Code: MSC-CS 313 T	**Title of the Course :** Advanced Database Management System
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes (COs):

- Gain the awareness of basic issues in Objected oriented data models
- Learn about Web-DBMS integration Technology and XML for Internet database applications.
- Familiarize the Data mining and Data warehousing techniques.

UNIT	Course Contents	Allotted Hours
Unit I	**Advance Database Management System-Concepts and Architectures** 1.1 Centralized 1.2 Client-Server 1.3. Server System 1.4. Parallel 1.5. Distributed 1.6. Web Based Systems	**(03)**
Unit II	**The Extended Entity Relationship Model and Object Model:** 2.1 The ER model revisited. 2.2 Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization 2.3 Relationship types of degree higher than two.	**(03)**
Unit III	**Object-Oriented Databases** 3.1 Overview of Object-Oriented concepts, Object identity, Object structure 3.2 Type constructors, Encapsulation of operations 3.3 Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; 3.4 Database schema design for OODBMS; OQL, Persistent programming	**(06)**

	languages; OODBMS architecture and storage issues 3.5 Transactions and Concurrency control, Example of ODBMS Object Relational and Extended Relational Databases: 3.6 Database design for an ORDBMS - Nested relations and collections; Storage and access methods, 3.7 Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; 3.8 Systems comparison of RDBMS, OODBMS,ORDBMS	
Unit IV	**Parallel Databases** 4.1. Introduction to Parallel Databases 4.2. Parallel Database Architecture 4.3. Input-Output Parallelism 4.4. Interquery and Intraquery Parallelism, Interoperational and Intraoperational Parallelism 4.5. Design of Parallel Systems 4.6. Parallelism on Multicore Processors **Distributed Database** 4.7. Introduction to Distributed Databases 4.8. Distributed DBMS Architectures 4.9. Homogeneous and Heterogeneous Databases 4.10. Distributed Data Storage 4.11. Distributed Transactions 4.12. Commit Protocols 4.13. Availability 4.14. Cloud Based Database 4.15. Concurrency Control and Recovery in Distributed Databases 4.16. Directory Systems	**(08)**
Unit V	**Data Exchange through XML** 5.1. Structure of XML Data 5.2. XML Schema 5.3. XML Document and Database Schema Storing and Extracting XML Document 5.4. XML Querying XML Data 5.5. Application Program Interface to XML 5.6. XML Applications **Information Retrieval & XML data** 5.7. Introduction to information retrieval 5.8. Indexing for Text search 5.9. Web search engines 5.10. Managing text in DBMS 5.11. Data model for XML	**(07)**

	5.12. XML DTD's, 5.13. Domain specific DTD's 5.14. Querying XML data	
Unit VI	**Enhanced Data Models for Advanced Applications:** 6.1. Active database concepts. Temporal database concepts.; Spatial databases 6.2. Concepts and architecture; 6.3. Deductive databases and Query processing; 6.4. Mobile databases, 6.5. Geographic information systems.	**(03)**

- **Suggested Readings:**

1. Database system concepts', 5th Edition – Abraham Silberschatz, Henry Korth, S, Sudarshan, (McGraw Hill International)
2. Database Management Systems - Raghu Ramkrishnan, Johannes Gehrke Second Edition, (McGraw Hill International)
3. Database Management System - Alexis Leaon, Mathews Leon, (leon press)
4. Fundamentals of Database Systems - Remez Elmasri , Shamkant Navathe

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Semester –III	**Paper -IV**
Course Code: MSC-CS 314 P	**Title of the Course:** Software Project Management Lab, Mini Project
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- Student will be able to practice acquired knowledge within the chosen area of technology for project development
- Identify,discuss and justify the technical aspects of chosen project with the comprehensive and systematic approach.

Teaching Scheme:
3 hours/week

Workload:

1. One teacher to be assigned for group of 6 students.

Guidelines:

- Each student must individually complete mini project in 3 month semester
- The teacher assigned will monitor the progressof the student throughout the semester for continuous assessment.
- Student should submit synopsis within first week of starting mini project.
- Continuous assessment guidelines:
  1. Student should submit a weekly report in the college to the teacher.
  2. The report should contain the following details: Name of student, project title, activities and results/output achieved in week and proposed work for next week.
  3. The weekly report should be duly signed by the student from teacher.
  4. Two presentations should be conducted for each student (first presentation after first month and second presentation after 2nd month)
  5. At the end of the semester, each student should prepare a report and submit a hard copy in the department.

Recommended Documentation contents:

Title page
Company / Institute certificate Internship
completion certificate **Abstract**

Introduction

-motivation
-problem statement
-purpose/objective and goals
-literature survey
-project scope and limitations

System analysis

-Comparative study of Existing systems
- scope and limitations of existing systems
-project perspective, features
- stakeholders
-Requirement analysis - Functional requirements, performance requirements, security requirements etc.

System Design

- Design constraints
- System Model: UML diagrams
- Data Model
-User interfaces

Implementation details

-Software/hardware specifications, etc.

Reports Testing

Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion and Recommendations & FutureScope

Bibliography and Reference

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Semester –III	Paper -V
Course Code: MSC-CS 315 P	**Title of the Course :** Machine Learning Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- Able to use specific frameworks as per applications need.
- Design java application using design pattern techniques.
- Process available data using python libraries and predict outcomes using Machine Learning algorithms to solve given problem.
- Able to estimate Machine Learning models efficiency using suitable metrics

Sr. No	Assignments
1.	Write a python program to Prepare Scatter Plot (Use Forge Dataset /Iris Dataset)
2.	Write a python program to find all null values in a given data set andremove them
3.	Write a python program the Categorical values in numeric format for agiven dataset
4.	Write a python program to implement simple Linear Regression forpredicting house price
5.	Write a python program to implement multiple Linear Regression for agiven dataset
6.	Write a python program to implement Polynomial Regression for givendataset
7.	Write a python program to Implement Naïve Bayes
8.	Write a python program to Implement Decision Tree whether or not toplay tennis
9.	Write a python program to implement linear SVM
10.	Write a python program to find Decision boundary by using a neuralnetwork with 10 hidden units on two moons dataset
11.	Write a python program to transform data with Principal ComponentAnalysis (PCA)

12.	Write a python program to implement k-nearest Neighbors ML algorithm to build prediction model (Use Forge Dataset)
13.	Write a python program to implement k-means algorithm on asynthetic dataset
14.	Write a python program to implement Agglomerative clustering on asynthetic dataset.
15.	Data Sets for ML - UCI Machine Learning Repository - www.kaggle.com

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Semester –III	**Paper -VI**
Course Code: MSC-CS 316 P	**Title of the Course :** SQL Server Management System Lab
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcome-

- Build and ,manage SQL Server Database
- Retrieve and Manipulate data with SQL Queries
- Secure and monitor database with Management Studio

Sr. No	**Assignments Contents**
1.	SQL data types, Operators, Literals, Constraints
2.	DDL, DML, TCL, DCL Commands
3.	Queries: Select / From / Where/ Group By/Having Clause/ Order By Clause/ SQL Operators
4.	Functions: Aggregate / Numeric / String / Date & Time / Logical
5.	Joins: Equi-Join / Natural Join / Self Join / Inner Join / Outer Join
6.	Unions / Intersection / Minus
7.	Subqueries or Nested Queries
8.	PL/SQL Block Structure
9.	Conditional Statements
10.	. Iterations
11.	. Database Programming with record variables
12.	. Cursors
13.	. Procedures & Functions
14.	. Triggers

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Semester –III	Paper -VII
Course Code: MSC-CS 317 T(A)	Title of the Course : Big Data
Credits: 02	Total Lectures: 30 Hrs.

Course Outcome:-

- A program to master big data technology.
- Provides an overview of apache Hadoop.
- Understand Map reduce Job.

Unit	Course Contents	Allotted Hours
Unit I	**Introduction to Big data** 1.1 Big Data: Definition and taxonomy 1.1.1SourcesofBigData 1.2. 3V's of BigData(need for Hadoop) 1.3.Varying data structures 1.4.Characteristic of Big Data 1.5.Applications of Big Data 1.6.Challenges in Big Data 1.7.Big Data Implications for Industries 1.8.Big Data Analytics for Telecom/Banking/Retail/HealthCare/IT/Operations	(07)
Unit II	**Emerging Database Landscape** 2.1 Scale-Out Architecture 2.2 RDBMS Vs Non- Database Relational Database 2.3 Workload & its characteristics Implication of Big Data Scale on Data Processing	(04)
Unit III	**Application Architecture & Data Modeling For Big Data And Analytics** 3.1Big Data Warehouse & Analytics 3.2 Big data Warehouse System requirements & Hybrid Architectures 3.3 Enterprise Data Platform Ecosystem 3.4 Big Data and Master Data Management 3.5 Understanding data integration Pattern 3.6 Big Data Workload Design Approaches 3.7 Map-Reduce patterns ,Algorithms and Use Cases	(06)
Unit IV	**The Hadoop Ecosystem** 1.1 Introduction to Hadoop	(07)

	4.2 Hadoop Architecture 4.3 History of Hadoop-Facebook,Dynamo,Yahoo,Google 4.4 Hadoop Components :HDFS, Mapreduce 4.5 Introduction to Pig,Hive ,HBase ,Mahout Installation of single node cluster-installation of java Hadoop configuration	
Unit V	**Extracting Value From Big Data** 5.1 Real Time Analytics 5.2 In-Memory Data Grid for real Time Analysis Map reduce & Real Time Processing ,Use Cases	(06)

- **Suggested Readings:**

1. Madhu Jagdeesh,Soumendra Mohanty,Harsha Srivatsa,"Big Data Imperatives: Enterprise Big Data Warehouse,BI Implementations and Analytics",1st Edition, Apress(2013)

2. Frank J.Ohlhorst,"Big Data Analytics:Turning Big Data into Big Money",Wiley Publishers(2012)

3. Cristian Molaro,Surekha Parekh,Terry Purcell,"DB2 11:The Database for Big Data & Analytics",MC Press,(2013)

4. Tom White,"Hadoop-The Definitive Guide,Storage and analysis at internet scale",SPD, O'Really.

5. DT Editorial Services,"Big Data, Black Book-Covers Hadoop2, MapReduce,Hive,YARN, Pig, R and Data Visualization" Dreamtech Press,(2015).

6. Big Data Case Study by Bernard Marr –Willey Publications.

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Semester –III	**Paper -VIII**
Course Code: MSC-CS 318 P(A)	**Title of the Course :** Big Data Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- It is expected to form teams and ask students to solve these case studies, discuss and work on solutions. (In- detail explanation for case studies below is given in the said book)

Sr. No.	**Assignments**
1.	Case study on Facebook
2.	Case Study on IoT Sensors
3.	Case Study on Telecom Industry
4.	Case Study on Banking
5.	Case study on Amazon
6.	Case Study on General Electric –By TCS
7.	Case Study on Uber
8.	Case Study on Netflix
9.	CDC(Corona Virus and other Pandemics)
Practical **Note: Slips should be designed on the basis of following topics at college level.** **The practical should be taken on the basis of above case studies.**	
1.	Navigating in Hadoop environment [Operationalcommands in Hadoop environment like moving, copying files. creating directories etc
2.	Understand HDFS
3.	Using Unix tools
4.	Development in Hadoop environment, using various Hadoop tools/utilities
5.	Develop mapReduce programs [Assignments] - Develop map Reduce functions either in Java or Python

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Semester –III	**Paper –VII**
Course Code: : MSC-CS 317 T(B)	**Title of the Course :** Web Analytics
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcomes (Cos)

- Understand the concept and importance of Web analytics in an organization and the role of Web analytic in collecting, analyzing and reporting website traffic.
- Identify key performace indicators for a given goal using various data sources, identify data relating to themetrics and key performance indicators.
- Explore effective Web analytics strategies and implementation and Understand theimportance of web analytic as a tool for e-Commerce,Twitter analytics,social media analytics,web analytics,mobile and Google analytics.

Unit	Course Contents	Allotted Hours
Unit I	**Introduction to Web Analytics** 1.1 What is Web Analytics? 1.2 Importance of web analytics 1.3 Web Analytics process 1.4 Types of Web analytics 1.5 Web analytics methods 1.5.1 log file analysis 1.5.2 page tagging 1.6 Web analytics tools 1.7 Web analytics technical requirements	(04)

Unit II	**Qualitative Analysis**	(04)
	2.1 Heuristic evaluations 2.1.1Conducting a heuristic evaluation 2.1.2Benefits of heuristic evaluations 2.2 Site Visits 2.2.1Conducting a site visit, 2.2.2Benefits of site visits 2.3 Surveys 2.3.1 Website surveys 2.3.2 Post-visit surveys 2.3.3 creating and running a survey 2.3.4 Benefits of surveys	
Unit III	**Web Metrics** 3.1 KPI 3.2 Dashboard 3.2.1 Implementation 3.2.2 Metrics 3.2.3 Types of metrics 3.3 Conversion 3.3.1 goals 3.3.2. funnels 3.4 Data sources 3.4.1 server log 3.4.2 visitors data 3.4.3 search engine statistics and conversion funnels 3.5 Data Segmentation 3.5.1 Analysis using segmentation 3.6 Emerging analytics 3.6.1 E-commerce 3.6.2 Twitter Analytics 3.6.3 A/B testing 3.7 Annotation and Reporting 3.7.1 Automated 3.7.2 Actionable	(09)

Unit IV	**Web Analytics Framework 2.0** 4.1 Introduction to analytic 2.0 4.2 Competitive intelligence analysis 4.3 CI data sources 4.3.1 Toolbar data 4.3.2 Panel data 4.3.3 ISP data 4.3.4 Search engine data 4.3.5 Hybrid data 4.4 Website traffic analysis 4.4.1 Comparing long term traffic trends 4.4.2 Analyzing competitive site overlap and opportunities 4.5 Mobile Analytics 4.5.1 Importance 4.5.2 Tools	(07)
Unit V	**Google Analytics** 5.1 Introduction to Google Analytics 5.2 How Google analytics works? 5.3 Google Analytics Reports 5.3.1 Audience analysis 5.3.2 Acquisition analysis 5.3.3Behaviour analysis 5.3.4Conversion analysis 5.4 Implementation 5.5 Google website optimizer	(06)

Suggested Readings:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed.

2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. 1st ed.

3. Kaushik A., Web Analytics: An Hour a Day, 1st ed.

4. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons

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Semester –III	**Paper –VIII**
Course Code: : MSC-CS 318 P(B)	**Title of the Course :** Web Analytics Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

-Learn how the cookies and sessions are useful in website data analysis.

-To understand the social web analytics through twitter and facebook mining.

-Study web analytics tool-Google analytics and how to track e-commerce sites using Google analytics.

Sr. No.	Assignment Name
1	Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
2	Write a PHP program to store page views count in SESSION, to increment the count on each refresh and to show the count on web page.
3	Write a PHP program to display a digital clock which displays the current time of the server.
	Case Study
4	**How to Make Web Analytics Work for Your Website?** - Web traffic data analysis- Objectives for visitors,Tracking conversion, Explain abandonment rates, Identify bounce rates, Determine cost per acquisition.
5	**How to increase Your Site's Visibility through Web Analytics?** Ways to increase visibility using web analytics- Scan search engines and improve ranking,Optimize content,Revisit advertising. Google metrics that help with website visibility- NAP citations,Keywords,Deep links

6	**Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, and More** Why Is Twitter All the Rage?, Exploring Twitter's API Fundamental Twitter Terminology, Creating a Twitter API Connection, Exploring Trending Topics, Searching for Tweets, Analysing the 140 Character, Extracting Tweet Entities, Analysing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms.
7	**Mining Facebook: Analyzing Fan Pages, Examining Friendships, and More** Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analysing Social Graph Connections, Analysing Facebook Pages, Examining Friendships.
8	**Consider the any E-Commerce site and to measure the web analytics** **Bounce Rate** If a person leaves your website within a span of 30 sec, it is considered as a bounce. The rate at which users spin back is called the bounce rate. To minimize bounce rate include related posts, clear call-to-action and backlinks in your webpages. **Behavior** Behavior lets you know page views and time spent on website. You can find out how customer behaves once he is on your website.
9	**Google Analytics :Installation and Understanding working**
10	**Using Google Analytics tracking E-commerce site.** -Setup E-commerce tracking in Google Analytics. **On-site** − It measures the users' behaviour once it is on the website. For example, measurement of your website performance. **Off-site** − It is the measurement and analysis irrespective of whether you own or maintain a website. For example, measurement of visibility, comments, potential audience, etc.

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Semester –III	Paper –VII
Course Code: : MSC-CS 317 T(C)	**Title of the Course :** Block Chain Management
Credits: 02	**Total Lectures: 30 Hrs.**

Course Outcome:-

- By the end of the course student will be able to understant how blockchain System Works.
- Design ,build and deploy smart contracts and distributed applications to securly interact with them
- To give students the understanding off emerging abstract model of blockchain Technology

Unit	Course Contents	Allotted Hours
Unit I	**INTRODUCTION TO BLOCKCHAIN** 1.1Blockchain- Public Ledgers Blockchain as Public Ledgers –Bitcoin 1.2 Blockchain 2.0, Smart Contracts 1.3 Block in a Blockchain 1.4 Transactions-Distributed Consensus 1.5The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain 1.6 Cryptographic -Hash Function 1.7 Properties of a hash function-Hash pointer and Merkle tree	(07)
Unit II	**BITCOIN AND CRYPTOCURRENCY** 2.1 A basic crypto currency, Creation of coins, Payments and double spending 2.2 FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network 2.3Transaction in Bitcoin Network, Block Mining, Block propagation and block relay 2.4 Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network	(06)
Unit III	**BITCOIN CONSENSUS** 3.1 Bitcoin Consensus 3.2 Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW 3.3 monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool- Permissioned model and use cases 3.4 Design issues for Permissioned Blockchains	(07)

	3.5 contracts- Consensus models for permissioned blockchain- 3.6 Distributed consensus in closed environmentPaxos	
Unit IV	**DISTRIBUTED CONSENSUS RAFT** 4.1 Consensus-Byzantine general problem 4.2 Byzantine fault tolerant system-Agreement Protoco l4.3 Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems 4.4 Practical Byzantine Fault Tolerance	(08)
Unit V	**BLOCKCHAIN APPLICATIONS** 5.1 Internet of Things-Medical Record Management System- 5.2Blockchain in Government and Blockchain 5.3 Security-Blockchain Use Cases –Finance	(04)

Suggested Readings:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

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Semester –III	**Paper –VIII**
Course Code: : MSC-CS 318 P(C)	**Title of the Course :** Blockchain Practical
Credits: 02	**Total Lectures: 60 Hrs.**

Course Outcomes:

- The Application of blockchain technology in the supply chain which provides an understanding of crypto currency.
- Programming skill for crypto currency and mining procedure using python.

Sr. No	Assignment Name
1.	Write a python program to create simple blockchain
2.	Write a python program to create block
3.	How to create a bitcoin wallet address with python
4.	To implement a mining Procedure
5.	Create your own python blockchain by using python code to define a single Block record ,define proof of work system and a mining procedure
6.	Write a python program to create miners in blockchain
7.	Using python to add blocks in blockchain
8.	Reating a blockchain using hashfunction
9.	Implementing cryptography in blockchain using python
10.	Create a blockchain bitcoin cryptocurrency

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Semester –III	Paper –IX
Course Code: MSC-CS 319 T	Title of the Course : Data Mining & Data Warehousing
Credits: 02	Total Lectures: 30 Hrs.

Course Outcomes

- Design a Data warehouse system and perform business analysis with OLAP tools.
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis

UNIT No.	Course Contents	Alloted Hours
UNIT I	**Introduction to Data Mining** 1. Introduction to Data Mining 1.1 Introduction to Data Mining 1.2 Need of Data Mining 1.3 What Can Data Mining Do and Not Do? 1.4 Data Mining Applications 1.5 Data Mining Process 1.6 Data Mining Techniques 1.6.1 Predictive modeling 1.6.2 Database segmentation 1.6.3 Link analysis 1.6.4 Deviation detection 1.7 Difference between Data Mining and Machine Learning	**(04)**
UNIT II	Data Warehouse 2.1 The Need for an Operational Data Store (ODS) 2.2 Operational Data Store 2.2.1 Types of ODS 2.2.2 Architecture of ODS 2.2.3 Advantages of the ODS	**(06)**

	2.3 Data Warehouse 2.3.1 Historical developments in data warehousing 2.3.2 Defining data warehousing 2.3.3 Data warehouse architecture 2.3.4 Benefits of data warehousing 2.4 Data Marts 2.5 Comparative Study of Data Warehouse with OLTP and ODS 2.5.1 Data warehouses versus OLTP: similarities and distinction	
UNIT III	Data Preprocessing , Data Warehouse Schema, Online Analytical Processing 3.1 Need for Data Preprocessing 3.2 Data Preprocessing Methods 3.2.1 Data cleaning 3.2.2 Data integration 3.2.3 Data transformation 3.2.4 Data reduction 3.3 Introduction to Data Warehouse Schema 3.3.1 Dimension 3.3.2 Measure 3.3.3 Fact Table 3.3.4 Multi-dimensional view of data 3.3.4.1 Star Schema 3.3.4.2 Snowflake Schema 3.3.4.3 Fact Constellation Schema (Galaxy Schema) 3.3.5 Comparison among Star, Snowflake and Fact Constellation Schema 3.4 Introduction to Online Analytical Processing 3.4.1 Defining OLAP 3.4.2 OLAP applications 3.4.3 Features of OLAP 3.4.4 OLAP Benefits 3.4.5 Strengths of OLAP 3.4.6 Comparison between OLTP and OLAP 3.4.7 Differences between OLAP and data mining 3.4.8 Representation of Multi-dimensional Data 3.8.1 Data Cube 3.8.2 Implementing Multi-d	**(08)**
UNIT IV	**Classification And Prediction** 6.1 What Is Classification? What Is Prediction? 6.2 Issues Regarding Classification and Prediction 6.2.1 Preparing the Data for Classification and Prediction 6.2.2 Comparing Classification and Prediction Methods 6.3 Classification by Decision Tree Induction 6.3.1 Decision Tree Induction 6.3.2 Attribute Selection Measures 6.3.3 Tree Pruning 6.3.4 Scalability and Decision Tree Induction 6.4 Bayesian Classification	**(07)**

	6.4.1 Bayes' Theorem 6.4.2 Naïve Bayesian Classification 6.4.3 Bayesian Belief Networks 6.4.4 Training Bayesian Belief Networks 6.5 Prediction 6.5.1 Linear regression 6.5.2 Non-linear regression	
UNIT V	**Clustering** 5.1. What is mean by Clustering? 5.2. K-means Clustering 5.3. Expectation Maximization (EM) algorithm 5.4. Hierarchical clustering, 5.5. Correlation clustering 5.6.Software for data mining and applications of data mining 5.6.1 Introduction to R tool	**(05)**

Suggested Readings:

1.Data Mining:Concepts and Techniques Second Edition Jiawei Han ,Micheline Kamber, Jian pei, Cambridge university press

2. Data Mining and DataWarehousing Principles and Practical Techniques, Parteek Bhatia

3. Data Warehousing, Data Mining & OLAP Alex Berson and Stephen J.Smith, Tata McGraw – Hill Edition

4. The Book of R first course in programming and statistics, Tilman M. Davis

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Semester –IV	Paper –I
Course Code: MSC-CS 411 P	Title of the Course : Industrial Training/ Institutional Project
Credits: 18	Total Lectures:

Course Outcomes:

1.Teaching Scheme for Industrial Training

2 hours/week

The Industrial Training /Institutional project is equivalent to 5 theory courses of 4 credits each.
Marks per 4 credits = 100 .
02 credits for internal evaluation.
The total weightage for Industrial/Institutional training is 550 marks.

Workload:

1.One mentor to be assigned for 6 students.
2. hours /week to be allotted for 6 students

Guidelines:

- Each student must individually complete **minimum 5 months** full time Industrial training /Institutional project in the 4th semester.
- College should assign a student mentor to every student. The mentor will monitor the progressof the student throughout the semester for continuous assessment.
- Student should submit a valid offer letter and synopsis within two weeks of starting theinternship.
- There will be continuous assessment of the work done by the student during the internship period.
- Continuous assessment guidelines:

1. Student should submit a weekly report in the college to the mentor.
2. The report should contain the following details: Name of student, project title, company name, company mentor, daily activities and results/output, proposed work for next week.
3. The weekly report should be duly signed by the student and company mentor/ institute guide (CM).
4. Student Mentor should maintain weekly attendance record for every student.
5. Two presentations should be conducted for each student (first presentation after first monthand second presentation after 3rd month)
6. Student Mentor should take feedback from the Company mentor regarding overall performance of the student.
7. At the end of the internship period, each student should prepare a report which should conform to international academic standards.
8. The report should follow the style in academic journals and books, with contents such as: abstract,background, aim, design and implementation, testing, conclusion and full references,

Tables and figures should be numbered and referenced to in the report.

Examination and Evaluation guidelines

5.4 The project done during internship period will be evaluated in the following manner:

IA - 150 marks + UE-400 marks.

5.5 The final presentation and documentation will be evaluated by three examiners:

1. Student mentor (appointed by respective college)
2. External examiner (appointed by the University)
3. IT expert (appointed by respective college)

IA (100 marks)				
Weekly Attendance	Weekly Reports	First Presentation	Second Presentation	Documentation
10	30	15	15	30

UE (300 marks)		
Mentor	IT Expert	External Examiner
100	100	100

Recommended Documentation contents:

Title page
Company / Institute certificate
Internshipcompletion certificate

Abstract Introduction

-motivation
-problem statement
-purpose/objective and goals
-literature survey
-project scope and limitations

System analysis

-Comparative study of Existing systems
- scope and limitations of existing systems
-project perspective, features
- stakeholders
-Requirement analysis - Functional requirements, performance requirements, security requirements etc.

System Design

- Design constraints
- System Model: UML diagrams
- Data Model
-User interfaces

Implementation details

-Software/hardware specifications, etc.

Reports Testing

Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion and Recommendations & FutureScope

Bibliography and Reference

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Semester –IV	Paper –II
Course Code: MSC-CS 412 T	Title of the Course : Course Work
Credits: 04	Total Lectures:

Course Work

Reading Course with Guide

For active participation and academic development final year students must prepared himself/herself by reading reference books/suggested readings by respective guide.

Guide will assign topic/ subject to the learner. The topic suggested is related with technology and related with full time industrial project work or learner contribution in collecting reference material, understanding the topic of the reading course and accordingly prepare the topic or the subject through self learning mode.

30% weightage should be given to punctuality, enthusiasm and aptitude of the students. Remaining ,70 % weightage for written examination may for this subject be conducted by respective guide

During IT period & completing reading course, it is desirable that student may present paper / poster in any conference. That will help to prove enthusiasm .

To earn the credit in this course is compulsory to complete the degree.

IA (150 marks)				
Weekly Attendance	Weekly Reports	First Presentation	Second Presentation	Documentation
20	40	20	40	30